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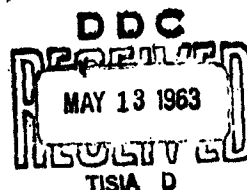
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CHESAPEAKE BAY INSTITUTE The Johns Hopkins University



ATLAS OF SALINITY AND TEMPERATURE
DISTRIBUTIONS IN CHESAPEAKE BAY 1952-1961
AND SEASONAL AVERAGES 1949-1961



by E. D. Stroup
and R. J. Lynn

Graphical Summary Report 2

Reference 63-1

February 1963

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CHESAPEAKE BAY INSTITUTE
THE JOHNS HOPKINS UNIVERSITY

ATLAS OF SALINITY AND TEMPERATURE DISTRIBUTIONS

IN CHESAPEAKE BAY 1952
AND SEASONAL AVERAGES 1949-1961

GRAPHICAL SUMMARY REPORT 2

E. D. Stroup and R. J. Lynn

This report contains results of work carried out for the U.S. Naval Research of the Navy Department under research project NR 083-016, Contract Nonr 248(20); the State of Maryland (Natural Resources Institute); and the Commonwealth of Virginia (Virginia Institute of Marine Sciences).

The preparation of this atlas was aided by funds supplied through Contract PH 86-62-79 with the U.S. Public Health Service, Department of Health, Education and Welfare

Reference 63-1
February 1963

D. W. Pritchard
Director

ACKNOWLEDGMENTS

The charts embodied in this report represent the combined effort of a number of the CBI staff. Special acknowledgment should be made to L. B. Brown, presently at Emertron, Inc., Silver Spring, Maryland, who did the painstaking calculations of area and volume of the Chesapeake Bay and its tributaries.

INTRODUCTION

This atlas has two major parts. Part I is a graphical summary of salinity and temperature observations from sixteen Bay cruises conducted during the period 15 July 1952 to 1 August 1961. There are sixteen sets of charts, one set for each cruise. Part II is a graphical presentation of the seasonal salinity and temperature distributions for the Chesapeake Bay as averaged from twenty-four Bay cruises conducted during the period 1 July 1949 to 1 August 1961. There are four sets of charts, one set for each season.

PART I

This atlas succeeds Graphical Summary Report I, Atlas of the Salinity and Temperature Distribution of Chesapeake Bay 1949-1951, by H. H. Whaley and T. C. Hopkins (1952) which covers Bay Cruises I through VIII. Bay Cruises IX, X, and XI do not contain enough information to permit meaningful contouring. The sixteen cruises summarized in this report are identified as Bay Cruises XII through XXVII. The salinity and temperature data, as well as other data when observed, are presented in tabular form in the following CBI reports:

<u>Bay Cruise</u>	<u>CBI Data Report</u>
XII	18
XIII	26
XIV-XVII	33-36
XVIII-XXVII	38-47

The methods of sampling and chemical analyses used are described in the data reports. The present graphical presentation, in which the observed distributions are smoothed to a certain extent, is intended to put this information into a form more useful to those interested in the physical and chemical hydrography of estuaries.

For each of the sixteen cruises, the atlas nominally contains (1) horizontal charts of salinity and temperature distributions at the 0, 10, 20, 30, 40, and 60-foot depth levels, (2) vertical salinity and temperature cross sections of the Bay at four locations, and (3) one vertical section along the main channel. The charts and sections for each cruise are grouped together; for certain cruises some sections or charts have been omitted because of insufficient data. The locations of the vertical sections, numbered II, IV, VI, X, and XIX, are shown on the first chart. The numerical-alphabetic designators at the tops of the sections represent the locations of stations. An explanation of the station designator symbols as well as a list of stations occupied during each cruise may be found in the individual CBI data reports.

The distributions of salinity and temperature are presented in the form of contours on all charts and sections except the charts for the 40-foot and 60-foot levels. On these latter charts selected observed values of salinity and temperature (rounded to the nearest tenth) were entered in place of drawing the contours. These exceptions were made because the 40-foot and 60-foot surfaces are small and broken, and usually the amount of data at these levels is insufficient for meaningful contouring.

In this report, locations of stations occupied during each cruise are shown in the first chart of each cruise set. Since the number of stations occupied varies greatly from one cruise to another, these station location charts can be used as a measure of the relative amount of information used in drawing the contours. For example, it can be seen in the station location chart for Bay Cruise XII that very few stations were occupied, so that the contours can be considered as only a very gross picture of the distributions.

The line across the northern part of the Bay in Bay Cruise XX was drawn to indicate that although stations were occupied north of the line, the data north of the line could not be considered synoptic with the data south of the line, because of a break in the time continuity of the cruise during a period of rapid change in conditions. There are no contours north of the line since too few data are available for meaningful contouring. A similar line was drawn in Bay Cruise XXII and the two parts of the Bay were contoured separately. A similar break occurred in Bay Cruise XIII, but since a number of stations were repeated, two complete sets of charts were made, one for February and one for March.

PART II

The seasonal average salinity and temperature distributions for the four seasons are presented in horizontal charts and vertical sections in the same manner as previously described for the individual Bay cruises. The seasonal averages have been computed from the 16 cruises presented in Part I of this report, together with the first eight Bay cruises as presented in Graphical Summary Report I. Division of the year into seasons was accomplished so as not to split any cruise into two seasons. The seasonal distribution of the cruises is shown in Figure 1. The length of each cruise is indicated by the length of the arc labelled with the number corresponding to that cruise.

It appeared that the most convenient method for constructing seasonal average charts was to use the temperature and salinity distribution charts already drawn up for the individual cruises. Use of the contoured distributions in constructing the seasonal averages (rather than averaging

observed data) avoids a difficulty that would otherwise arise due to the variable locations of station data taken at different times. A certain basic set of stations was occupied on a majority of the cruises, but there are a number of stations that were occupied on only a small number of cruises.

The seasonal average charts were formed in the following manner. A grid of points was made for the horizontal charts. Sixty-seven points were used in the grid, located so as to cover the Bay evenly. The grid was used as an overlay for each chart, and values of temperature and salinity at the grid points were tabulated for all cruises. This was accomplished for each depth level. Next, for each point the mean temperature and salinity were computed using data from all cruises within each season, and the mean values were replotted on charts. These charts were then contoured and are presented here. A like system was employed for the vertical sections.

AREA AND VOLUME STATISTICS

The areas and volumes computed for the Chesapeake Bay and seven of its major tributaries are included in this atlas as Table I for the convenience of those interested in the Chesapeake Bay. The base lines used to define the Bay and each tributary are also given. In the area and volume computations the Chesapeake Bay was defined to include all tributaries and embayments shown on U.S. Coast & Geodetic Survey charts nos. 77 and 78. This excludes the Susquehanna River north of 39° 36' N. The areas were computed by planimetry. Depth contours were drawn on the charts at 10-foot intervals. The areas of the 0, 10, 20, 30, 40, 60, 80, 100 and 120-foot levels are given in Table I. The areas of every 10-foot level from the surface to the deepest point in the Bay were used for estimation of the volume of the Bay according to Simpson's rule.* The standard error of arithmetic mean of the planimetry is 0.1%. Considering all sources of error, the statistics are considered good to within $\pm 1\%$.

The actual area and volume of the Bay vary with the tide. The Coast & Geodetic Survey charts are drawn for mean low water. Since mean low water cannot exist everywhere at one time, the Bay under normal conditions always has a greater surface area and total volume than listed here. The actual values of surface area and total volume at any given time could be obtained from the tabulated values by adding some amount which is a function of the tide. For example, there is an addition of approximately 0.7% in volume at the phase of the tide when the least

* Simpson's rule for computing the volume of an irregular solid can be found in most mathematical tables (see, for instance, Handbook of Chemistry and Physics, Chemical Rubber Publishing Co.).

amount of water is in the Bay, and an addition of approximately 2% in volume at the phase of the tide when the greatest amount of water is in the Bay. (These figures do not describe the volume changes due to unpredictable, wind-caused variations in water surface elevation, which can be considerably larger than the astronomical tide in Chesapeake Bay.)

TABLE I

Areas and Volumes at Mean Low Water, Computed
from U.S. Coast & Geodetic Survey Charts 77 and 78.

Chesapeake Bay and Tributaries

	Area			Volume between Designated Level and Bottom			
	10^9 ft^2	10^2 km^2	naut mi ²		10^{10} ft^3	km^3	%
surface	120.5	112.0	3260	surface	260.7	73.8	100.0
10 ft	79.0	73.4		10 ft	161.6	45.8	61.0
20 ft	52.3	48.6		20 ft	97.7	27.7	37.5
30 ft	33.7	31.3		30 ft	54.2	15.4	20.8
40 ft	17.1	15.9		40 ft	29.7	8.4	11.4
60 ft	4.9	4.6		60 ft	11.3	3.2	4.3
80 ft	2.3	2.1		80 ft	4.6	1.3	1.8
100 ft	.8	.8		100 ft	1.0	.3	.4
120 ft	.2	.1		120 ft	.2	.06	.1

Primary Tributaries of the Chesapeake Bay

	Surface Area		Volume	
	10^9 ft^2	10^8 m^2	10^{10} ft^3	10^8 m^3
Chester	1.55	1.44	1.96	5.56
Choptank	2.40	2.23	3.78	10.70
James	7.04	6.54	8.26	23.39
Patuxent	1.52	1.41	2.67	7.57
Potomac	13.75	12.78	25.72	72.83
Rappahannock	4.13	3.83	6.12	17.33
York	1.74	1.62	2.80	7.93
TOTAL	32.1	29.8	51.3	145.3
% of total for Bay	26.7%		19.7%	

Base line used to define the mouth of the Chesapeake Bay

Cape Charles (37° 07.4' N., 75° 57.2' W.)
to
Smith Island (37° 07.3' N., 75° 54.4' W.)
to
Cape Henry (36° 55.6' N., 76° 00.4' W.)

End points of base lines used to define river mouths
of the primary tributaries

Chester (39° 02.4' N, 76° 18.2' W.) (39° 02.4' N, 76° 14.4' W.)
Choptank (38° 40.2' N, 76° 20.4' W.) (38° 37.8' N, 76° 17.5' W.)
James (36° 00.1' N, 76° 18.4' W.) (36° 59.1' N, 76° 18.2' W.)
Patuxent (38° 21.8' N, 76° 23.2' W.) (38° 17.3' N, 76° 22.4' W.)
Potomac (38° 02.2' N, 76° 19.3' W.) (37° 53.4' N, 76° 14.1' W.)
Rappahannock (37° 36.7' N, 76° 16.8' W.) (37° 33.5' N, 76° 17.9' W.)
York (37° 15.0' N, 76° 22.6' W.) (37° 14.1' N, 76° 23.2' W.)

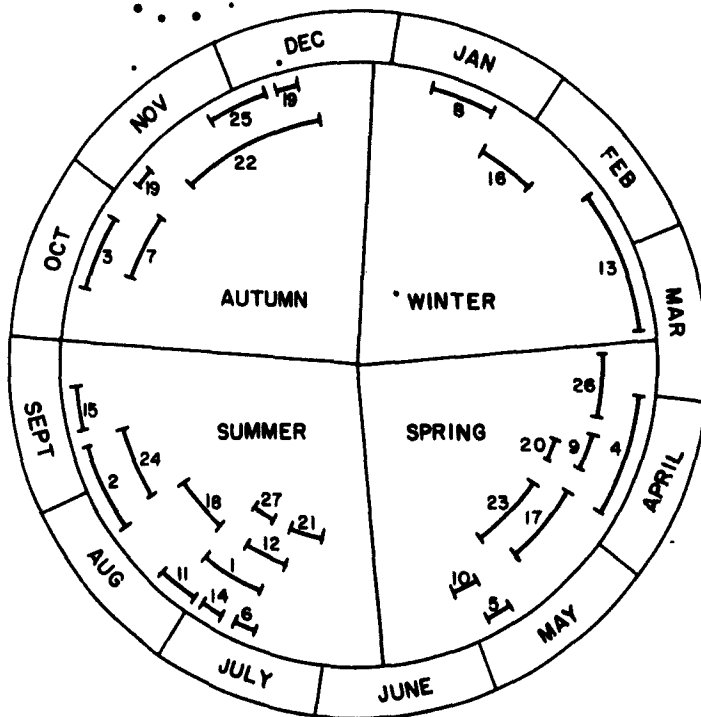
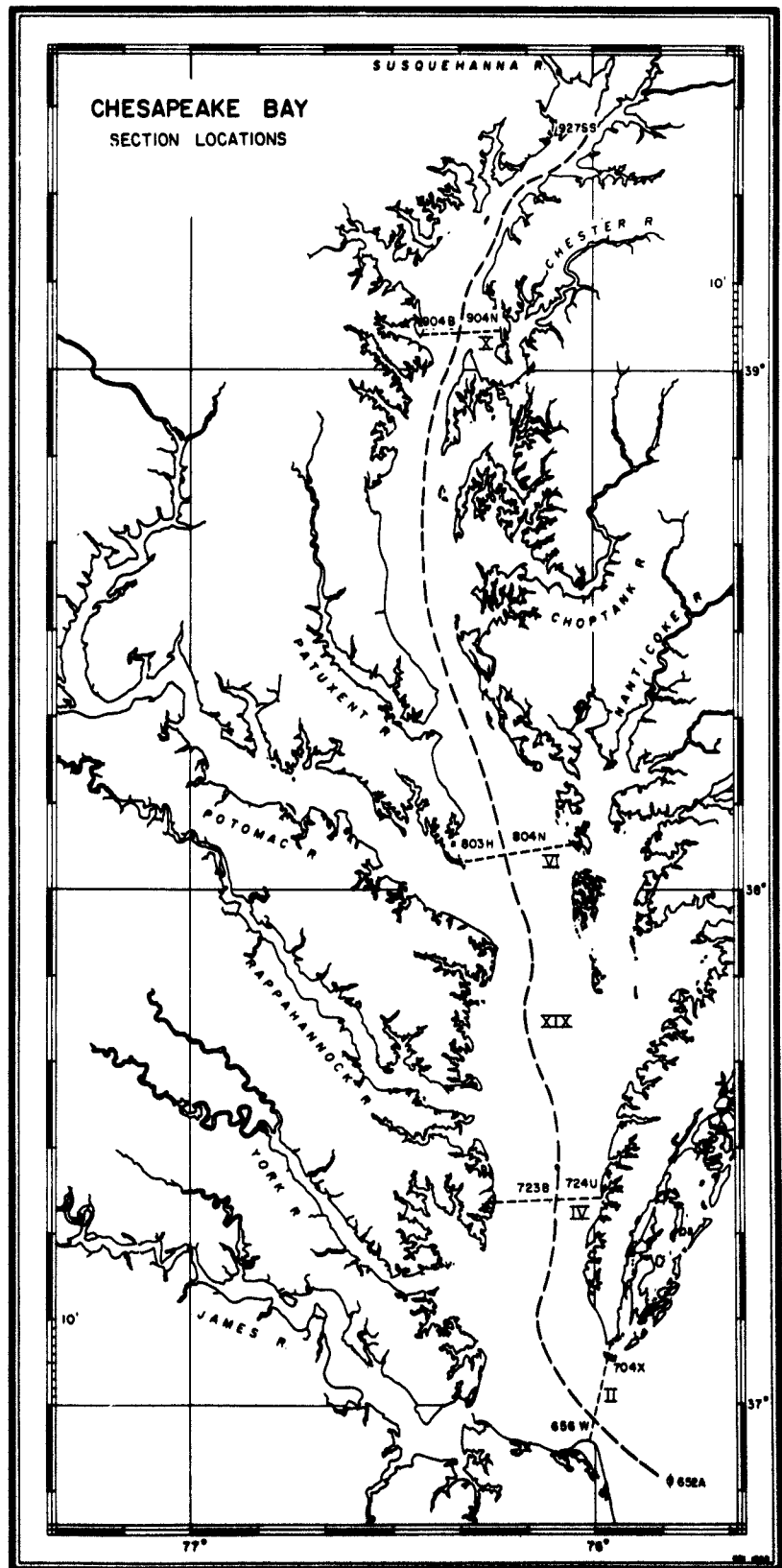
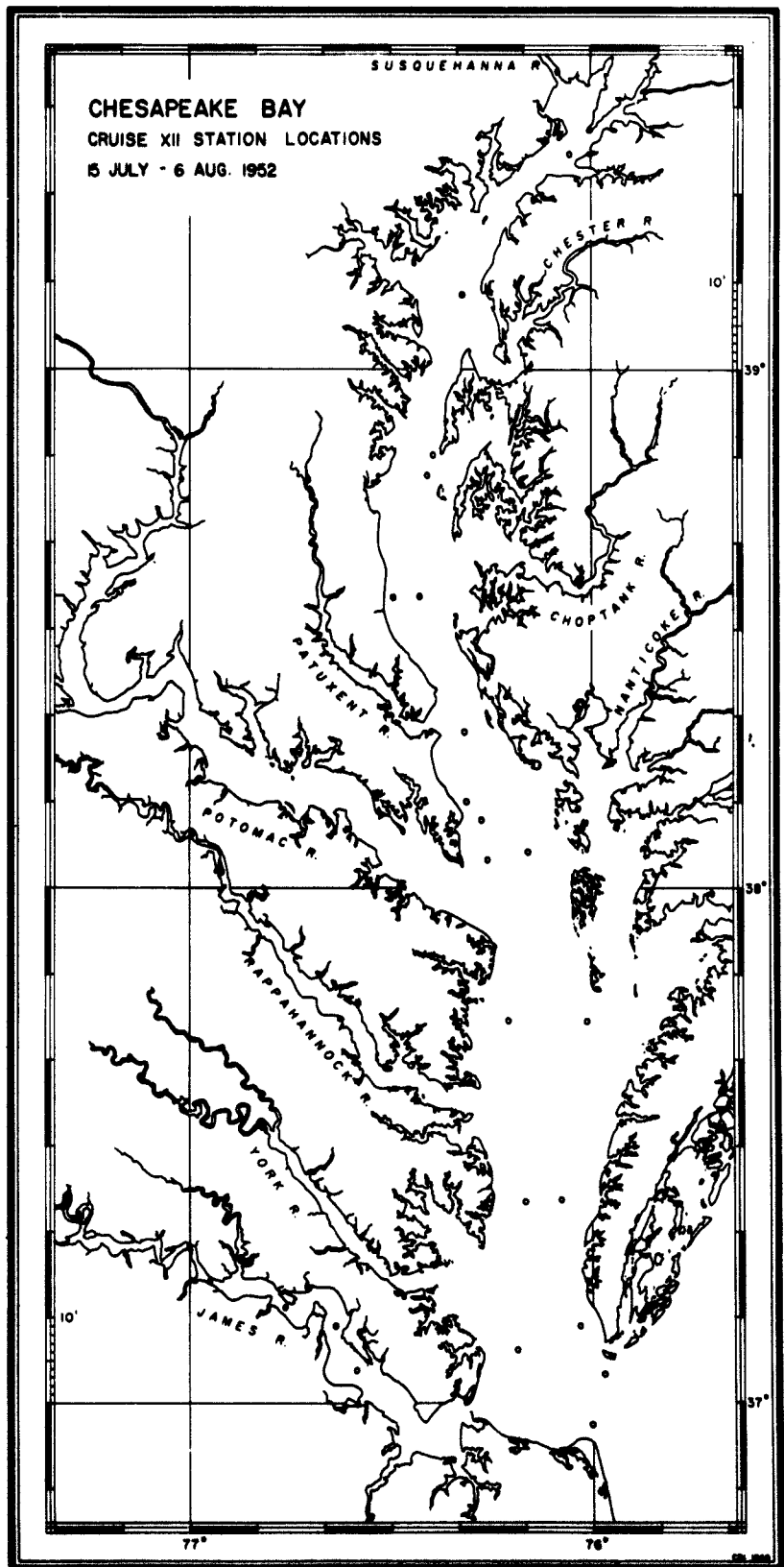
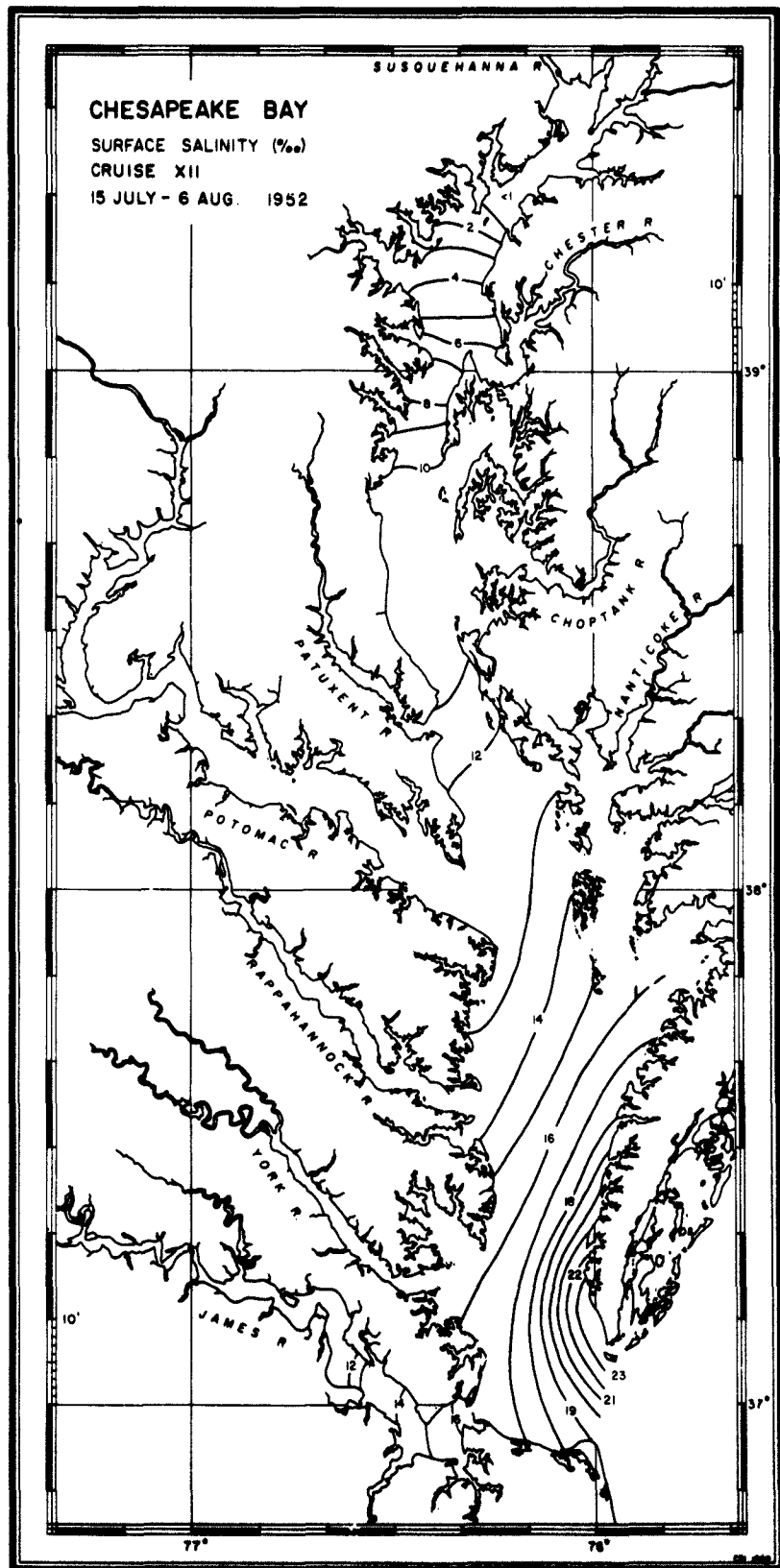
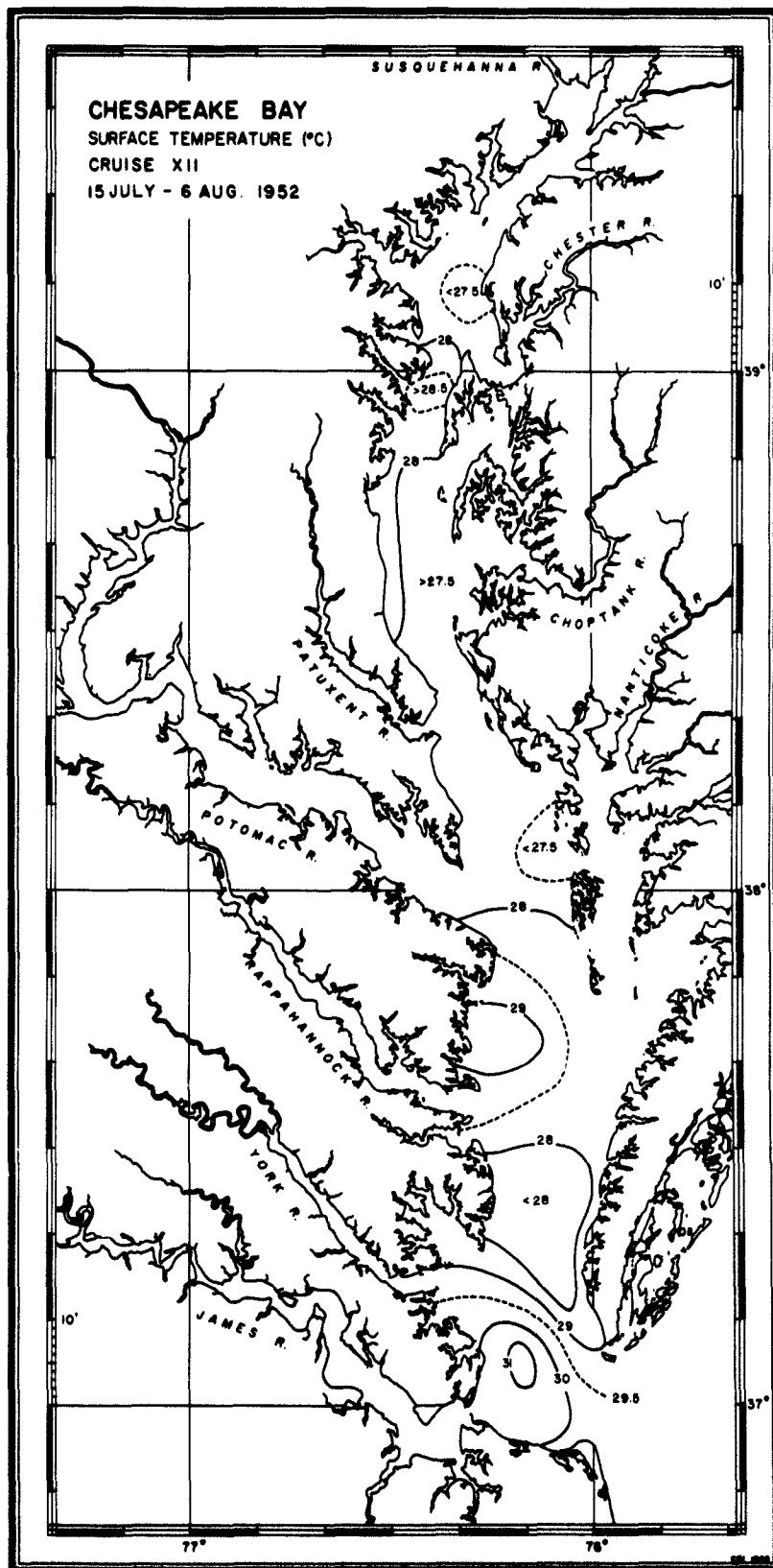


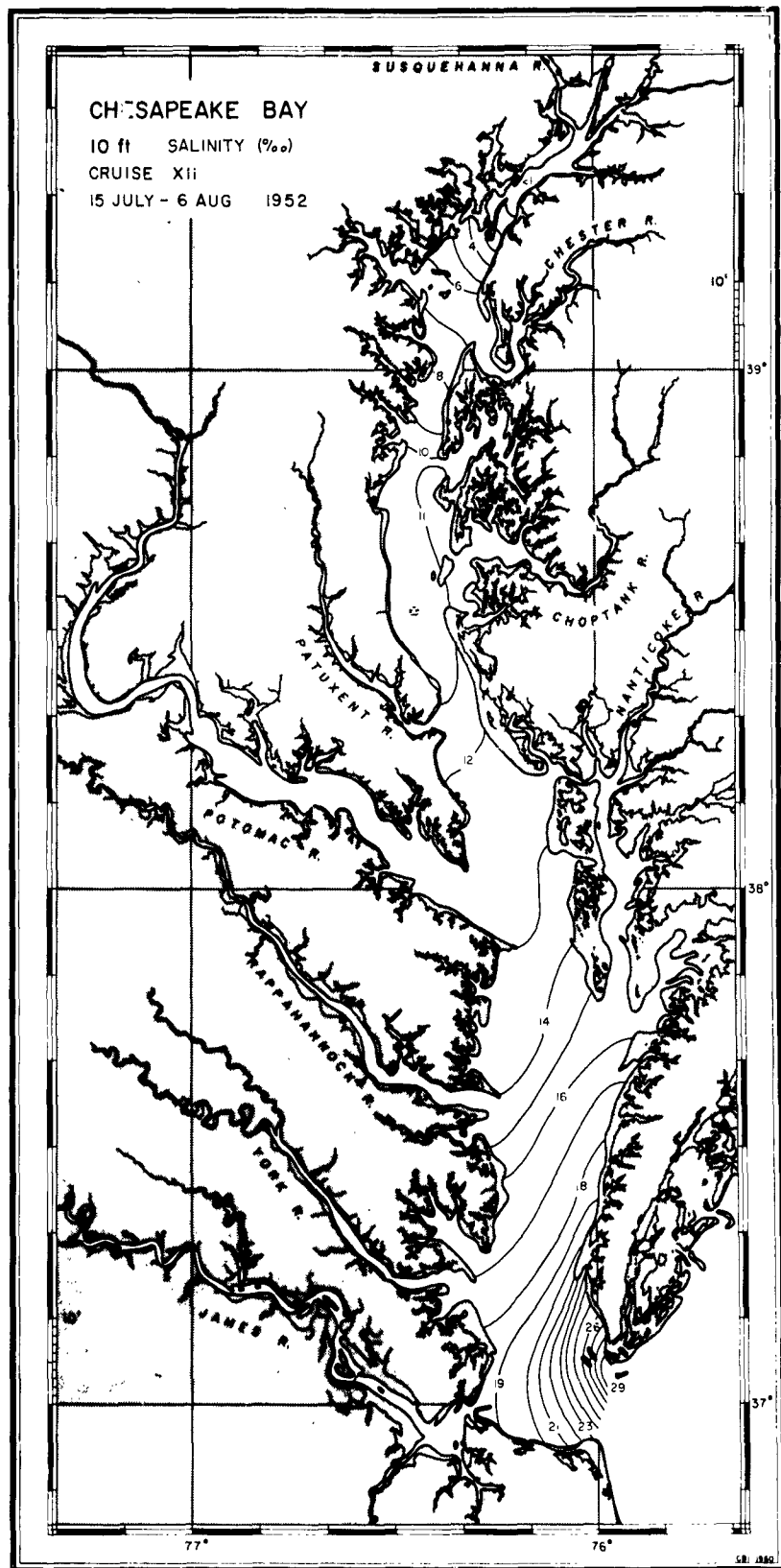
FIGURE 1. SEASONAL DISTRIBUTION OF BAY CRUISES 1 - 27.

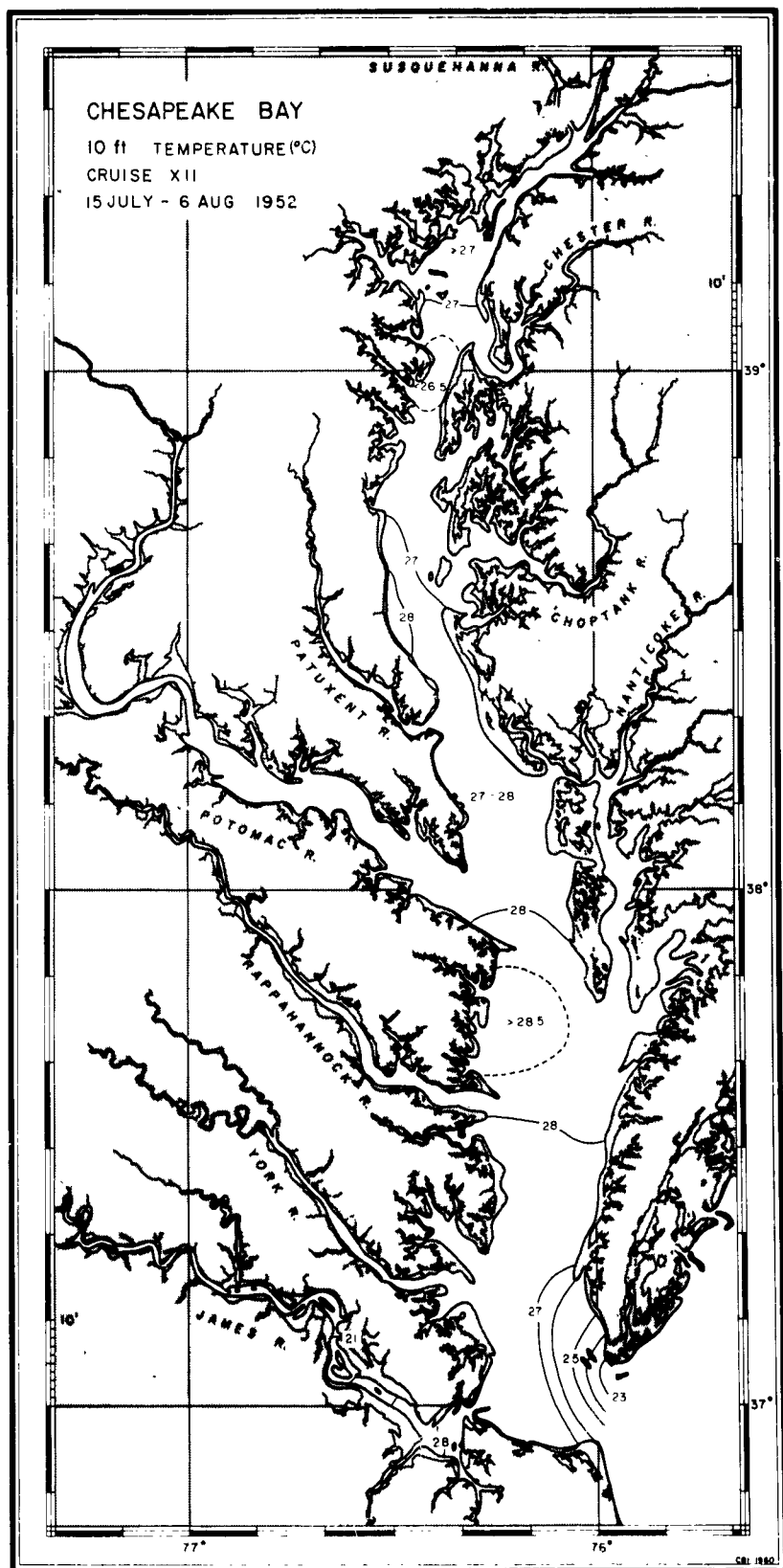


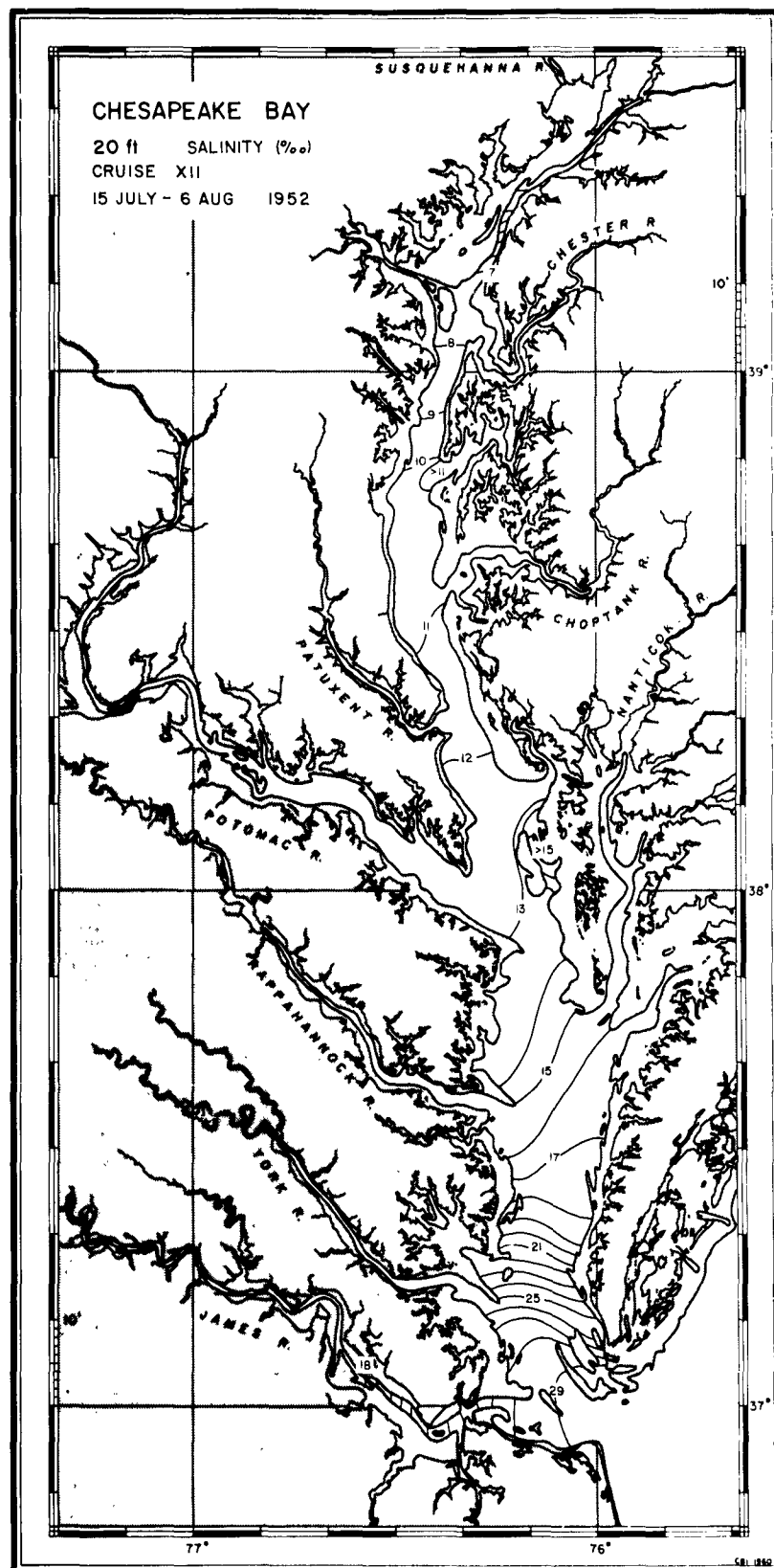


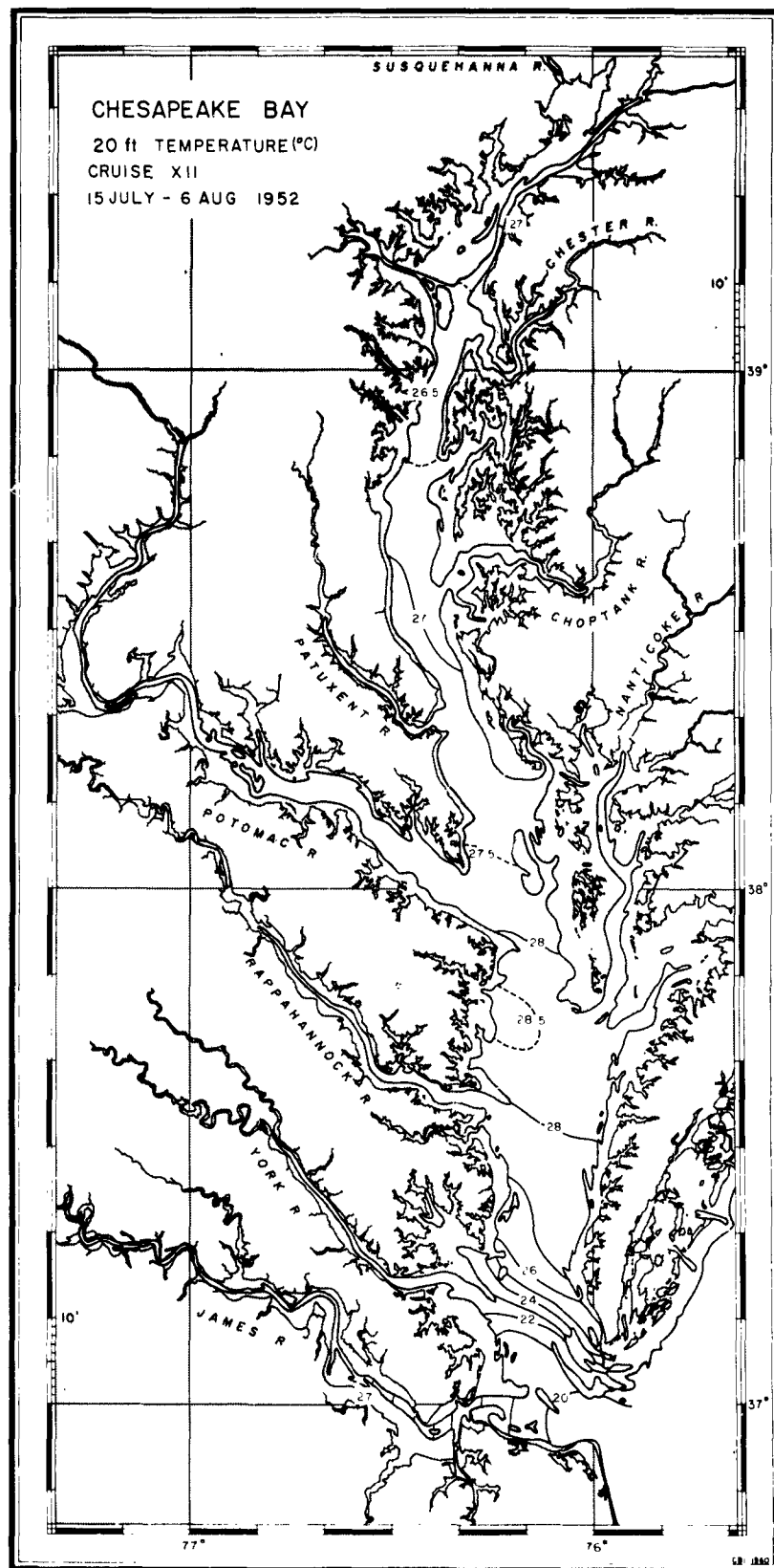


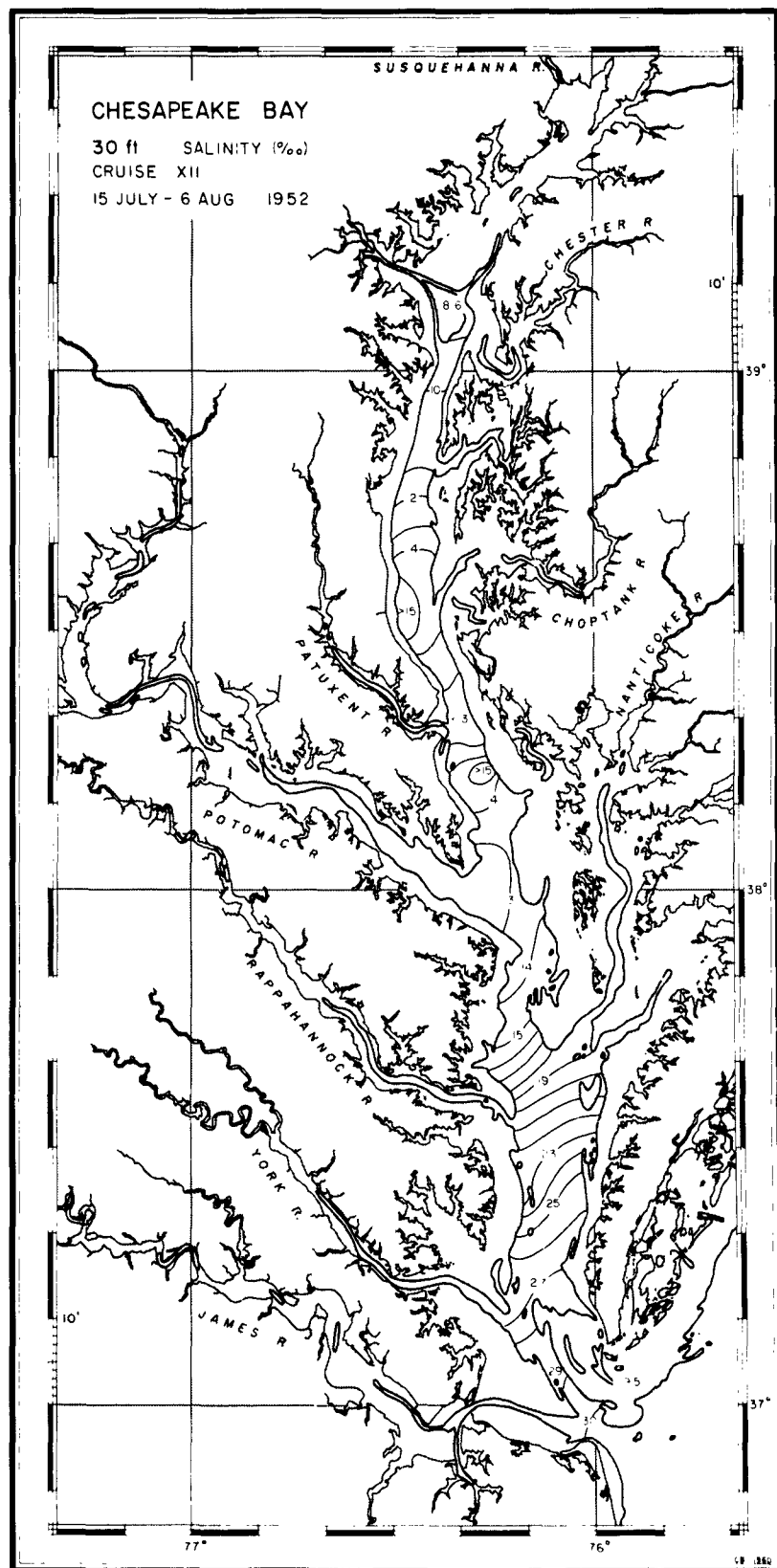


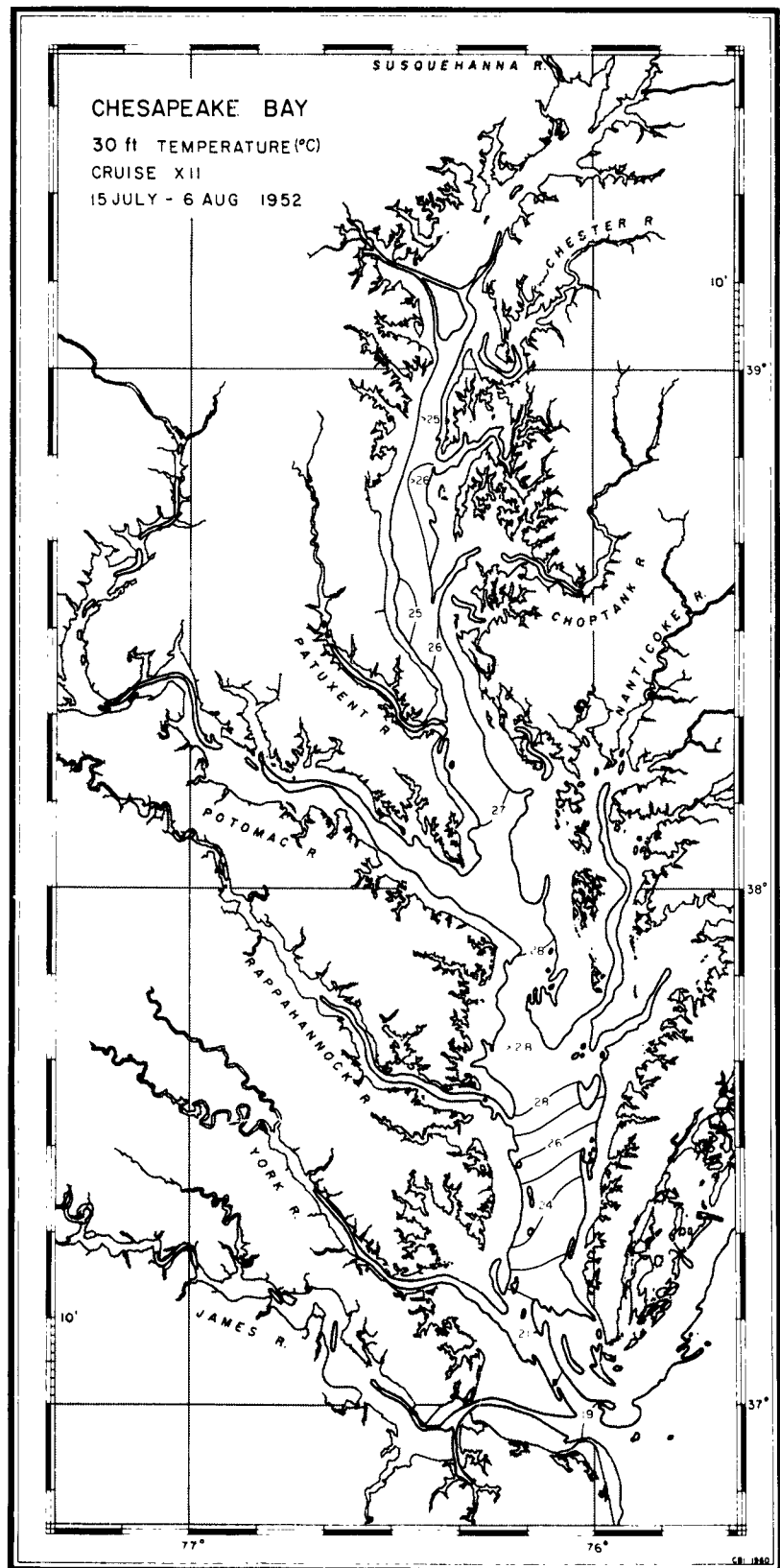


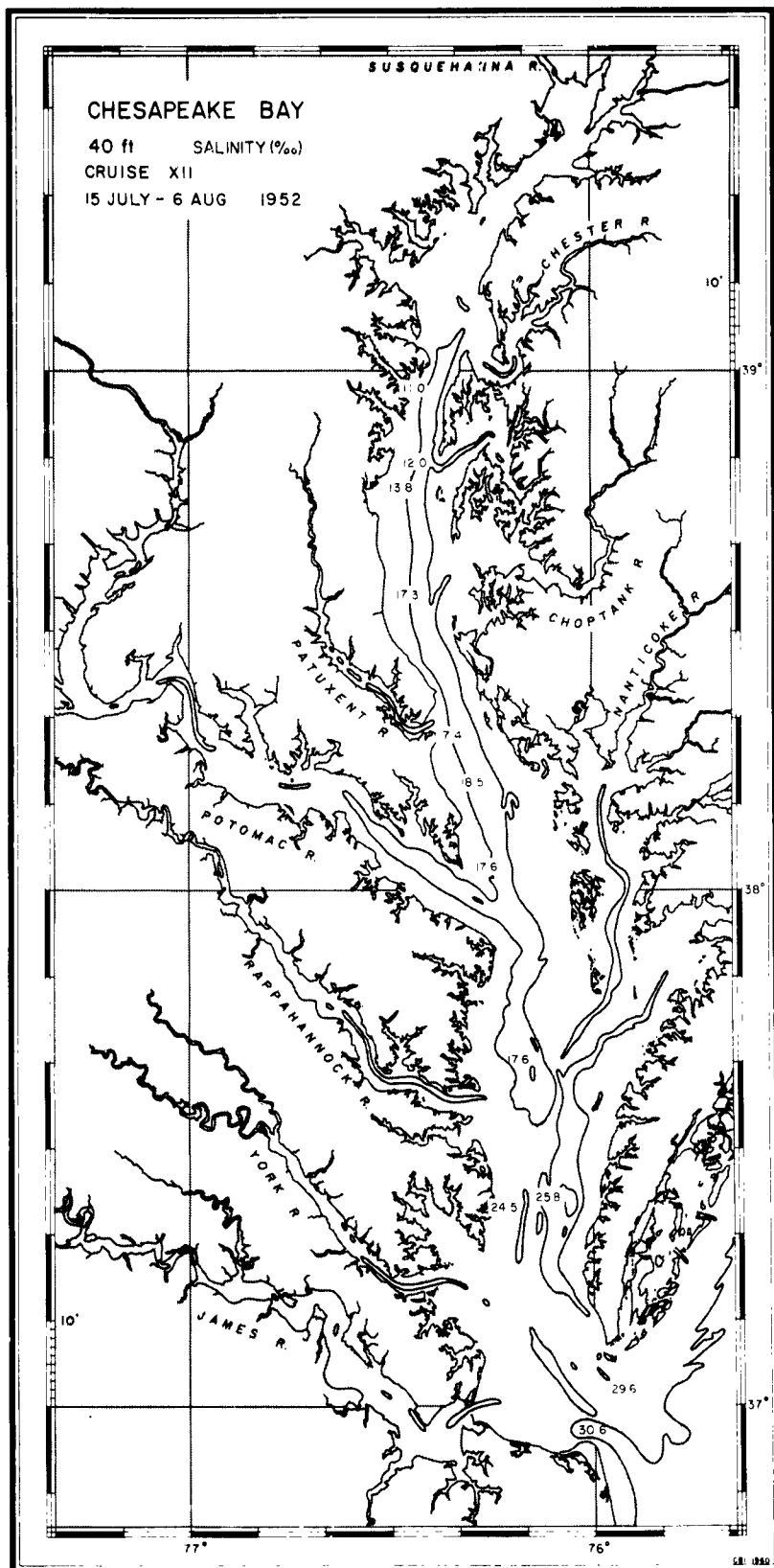


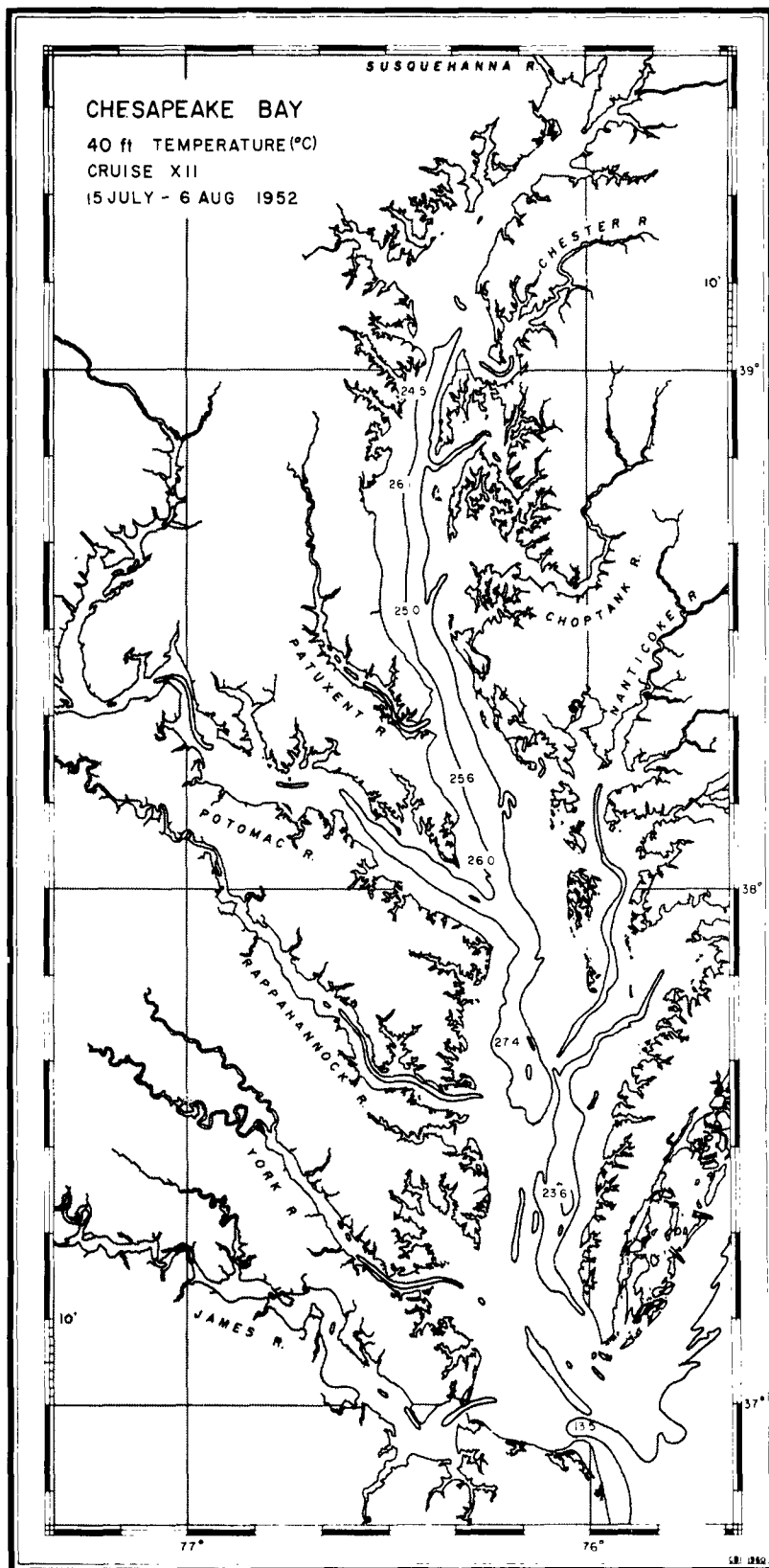


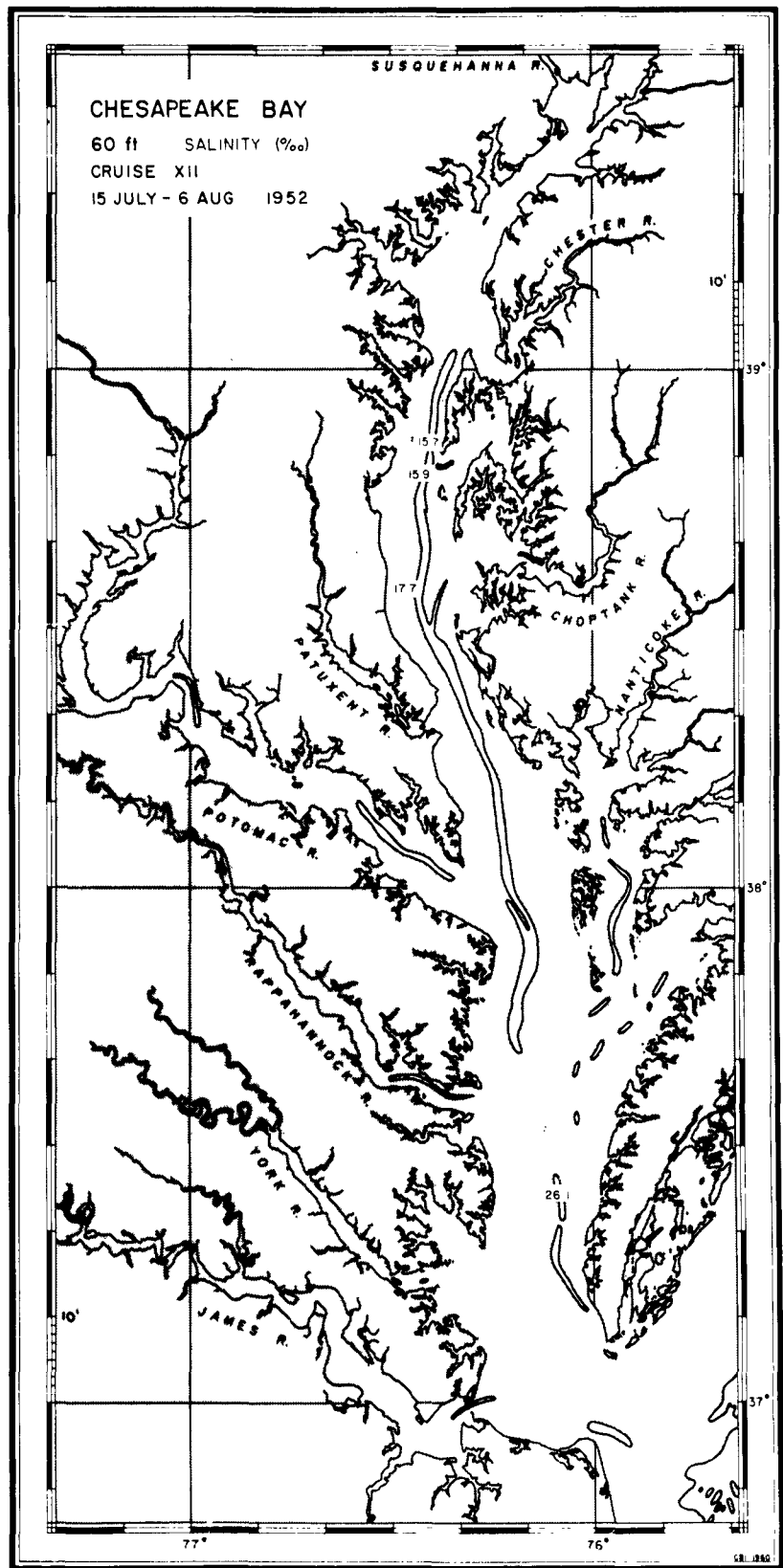


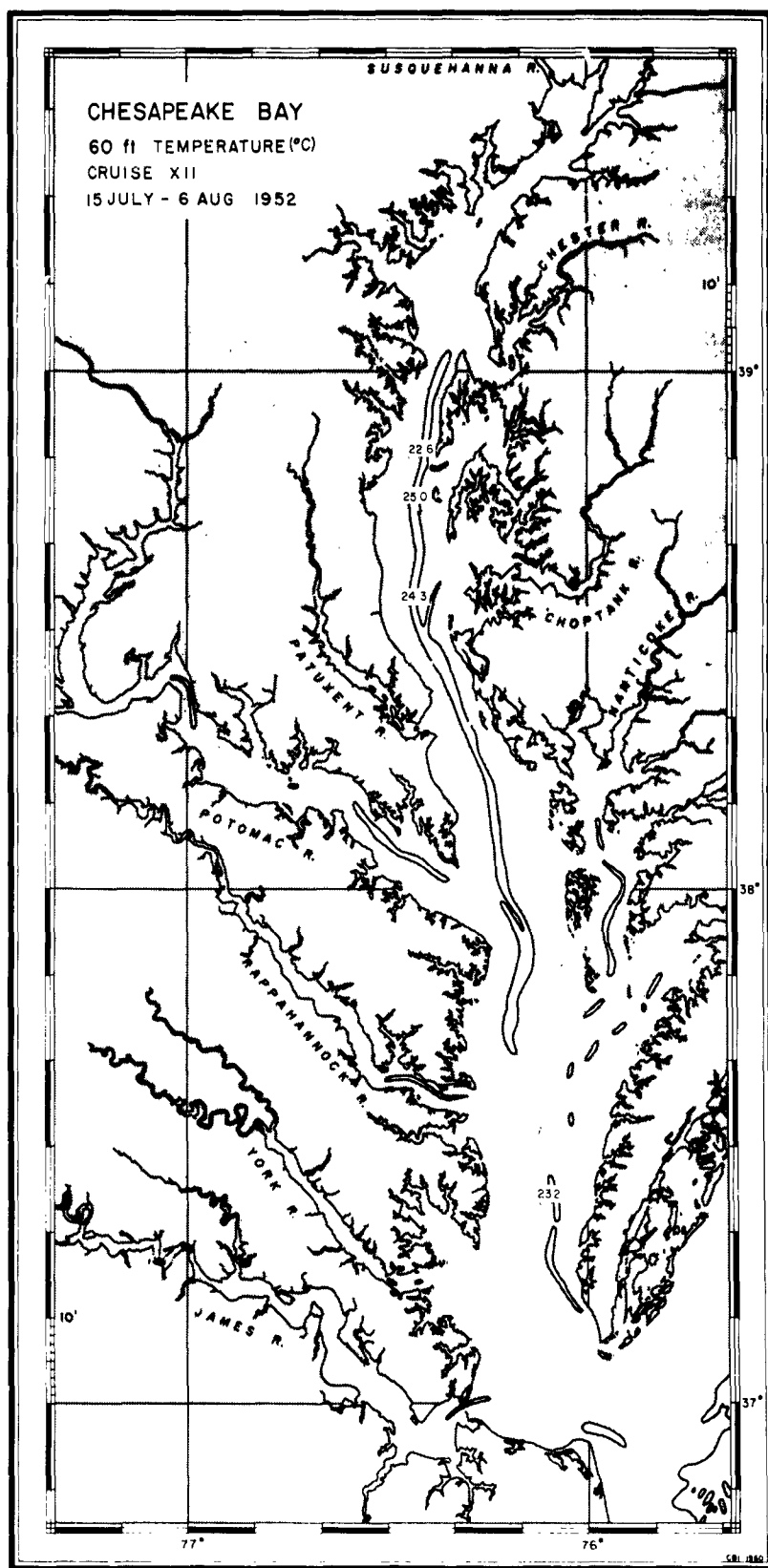




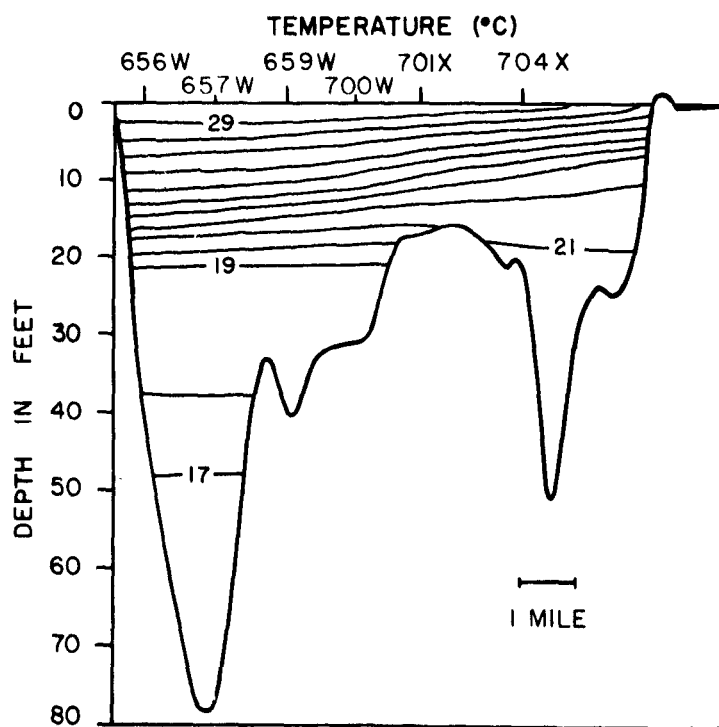
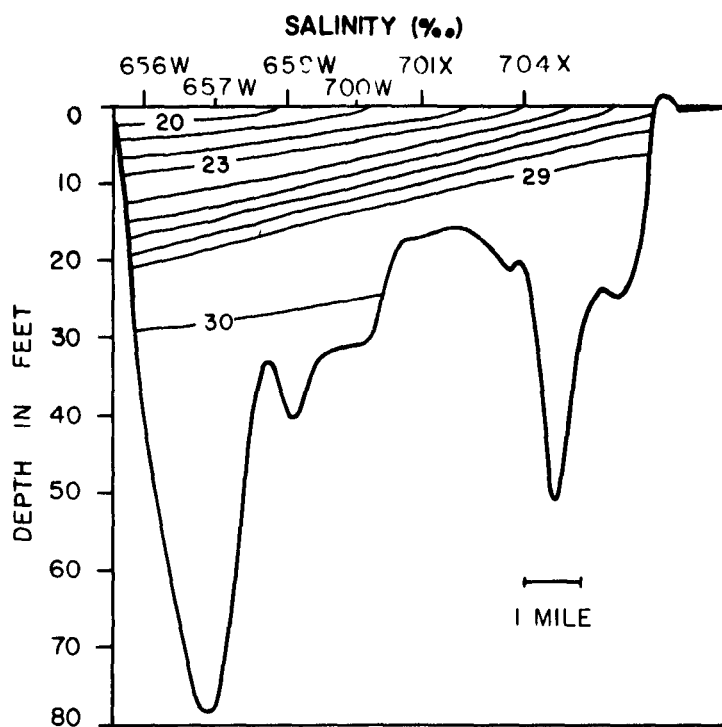




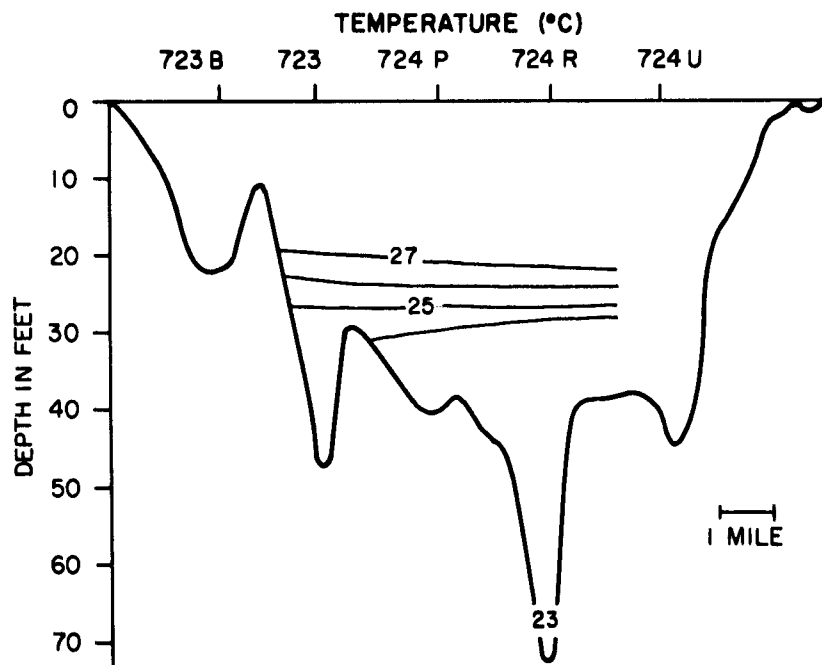
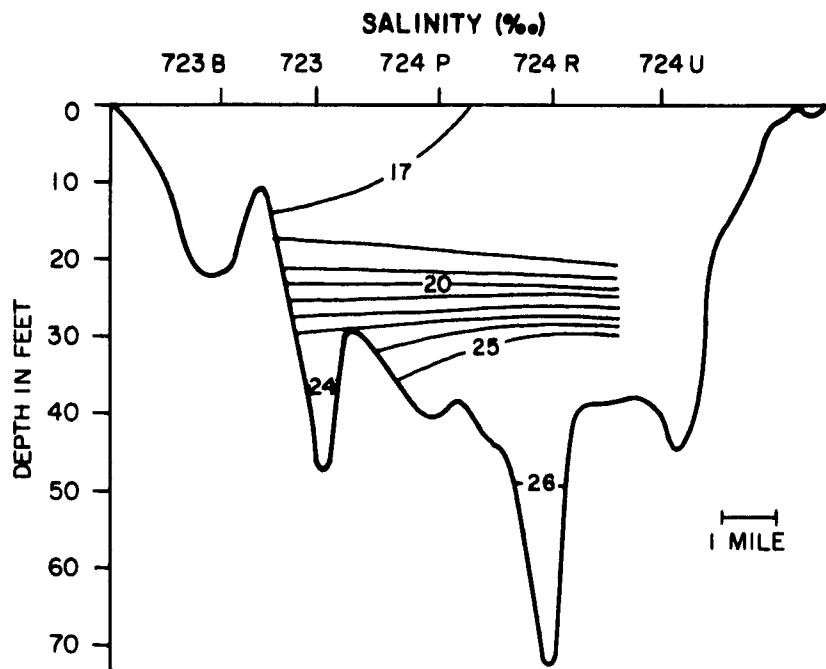


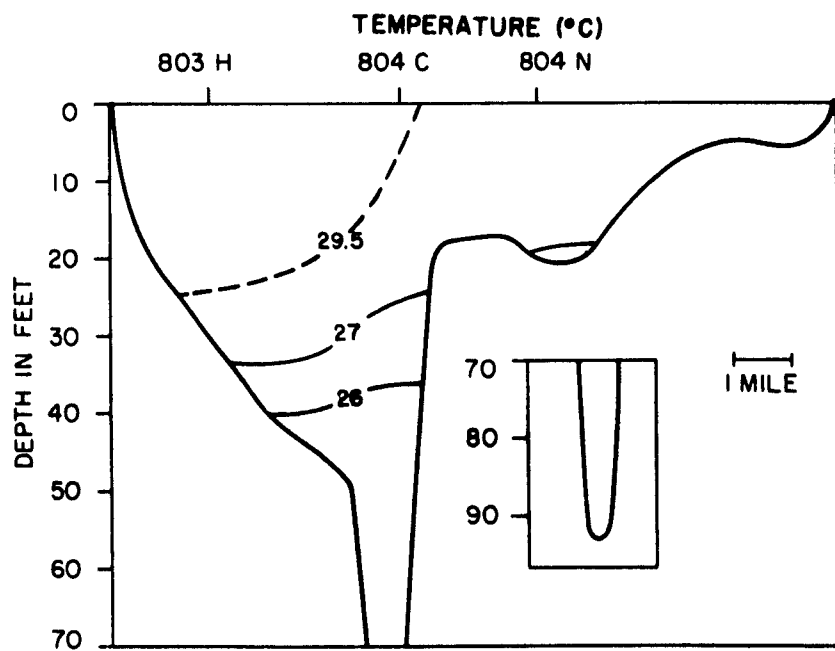
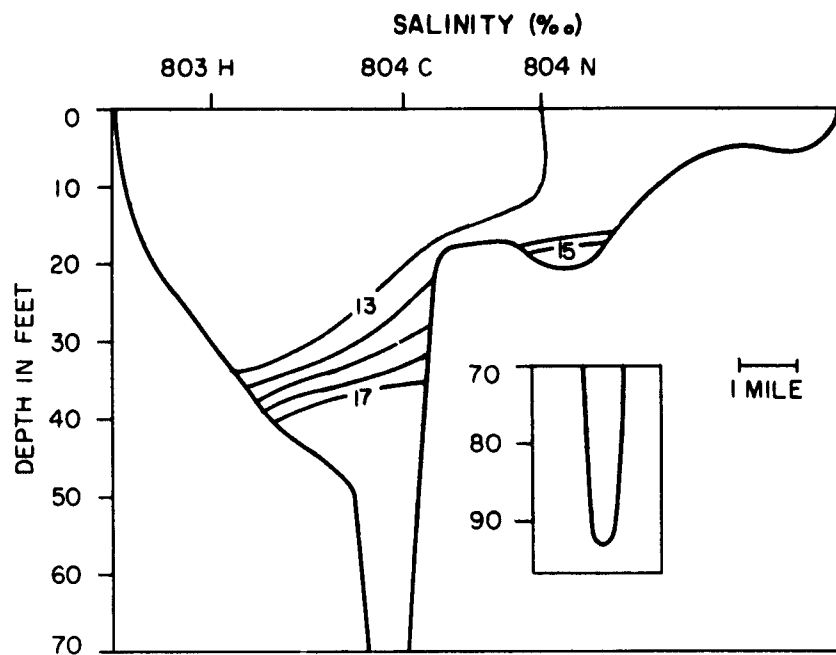


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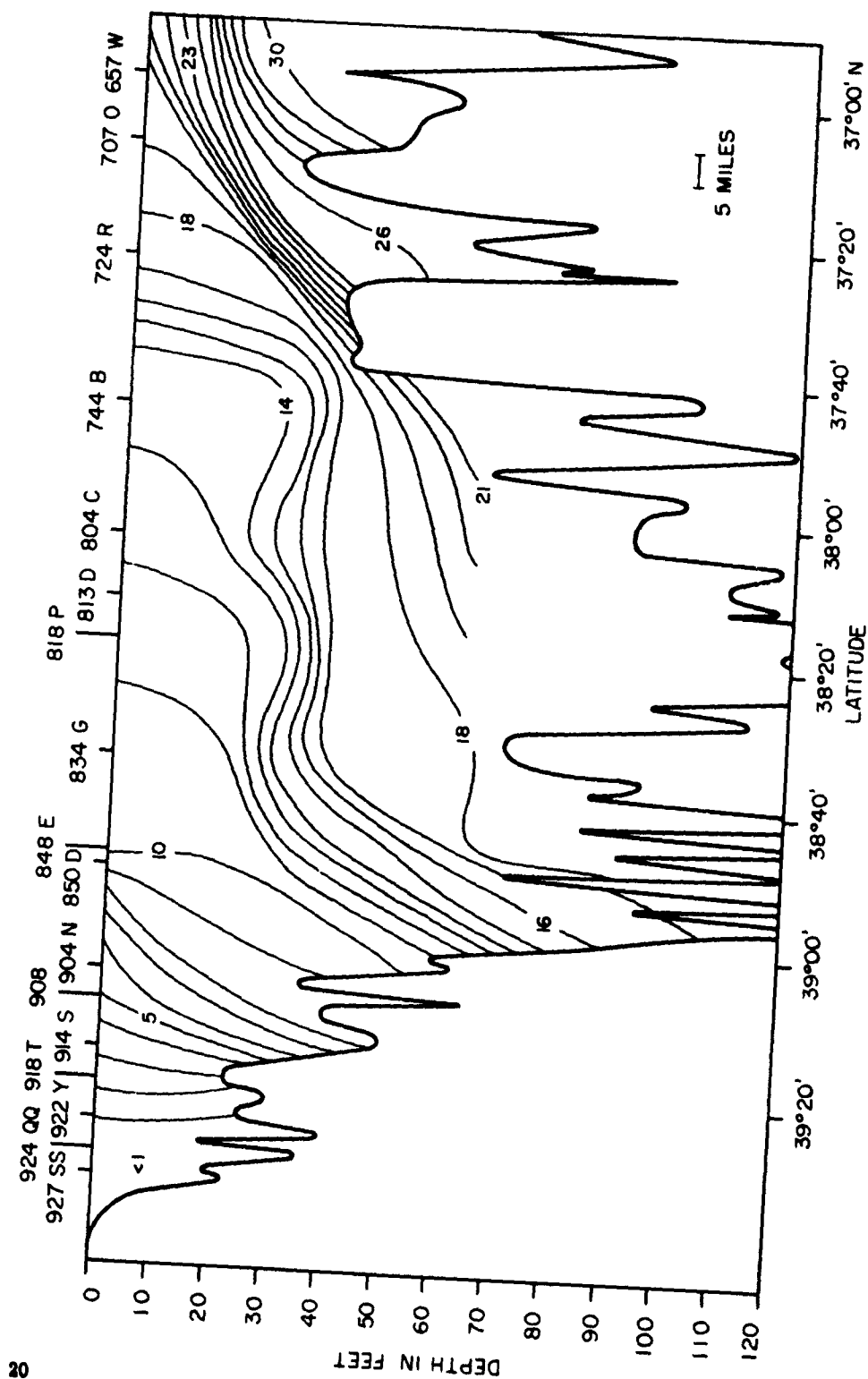
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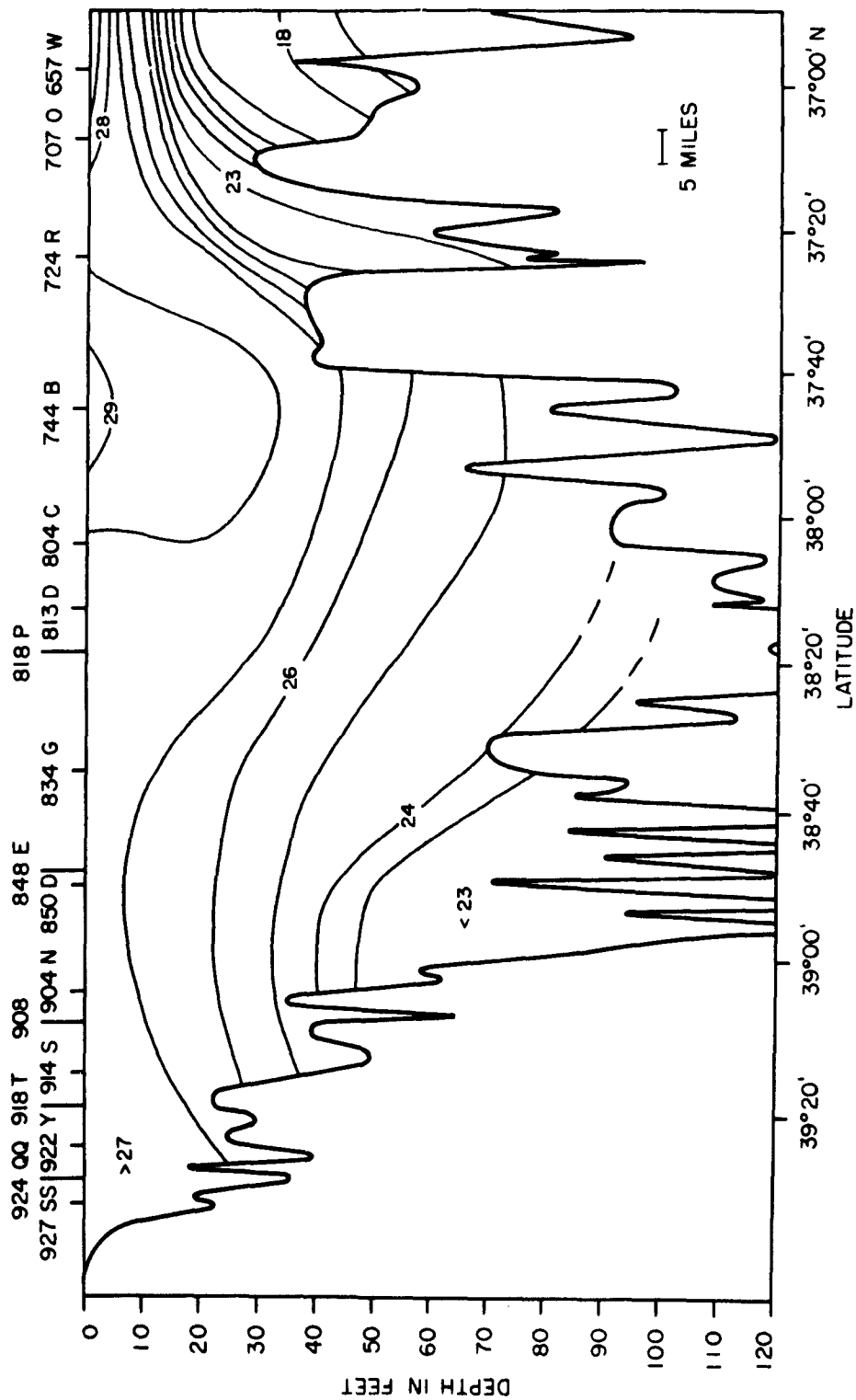


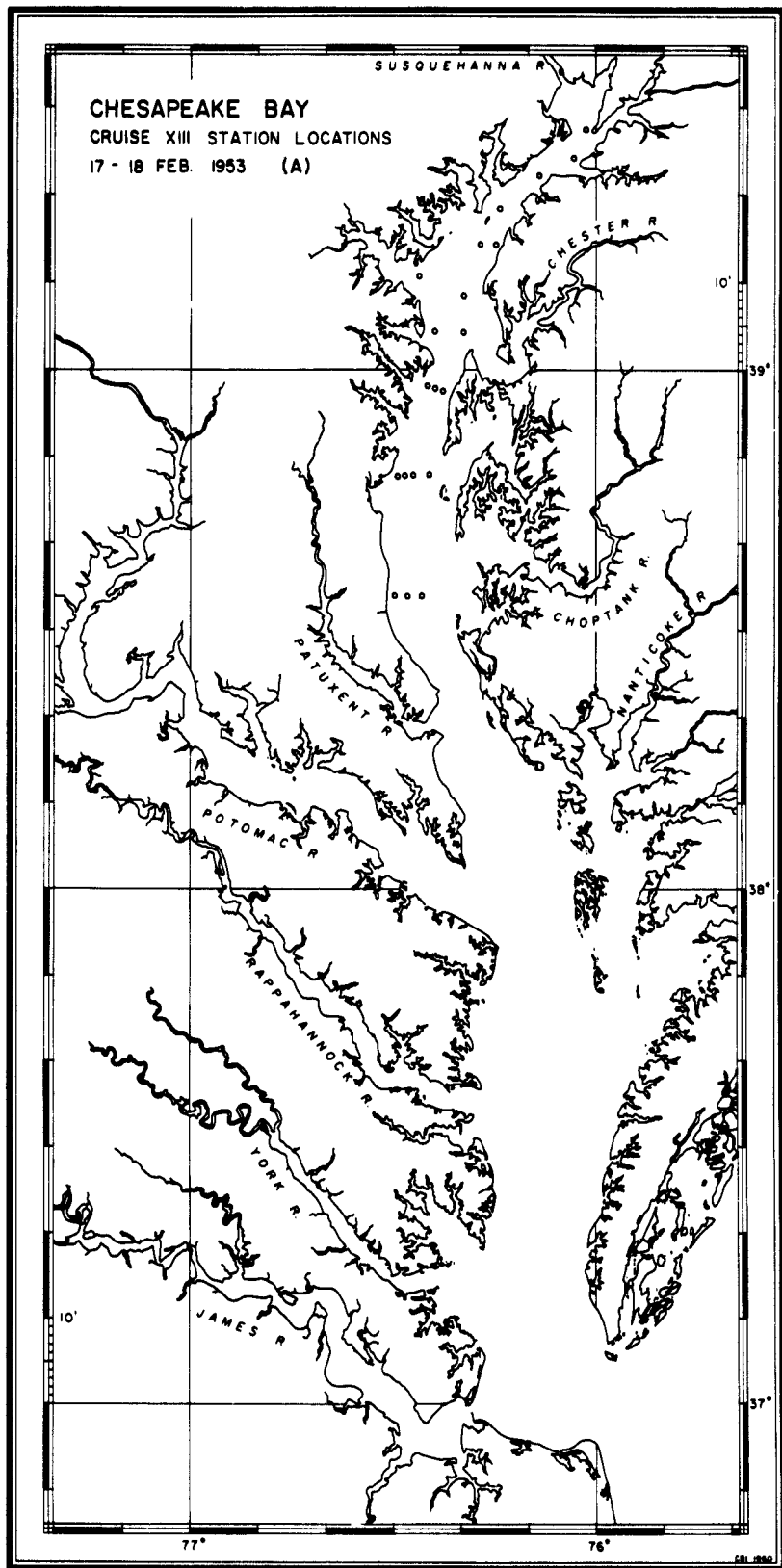
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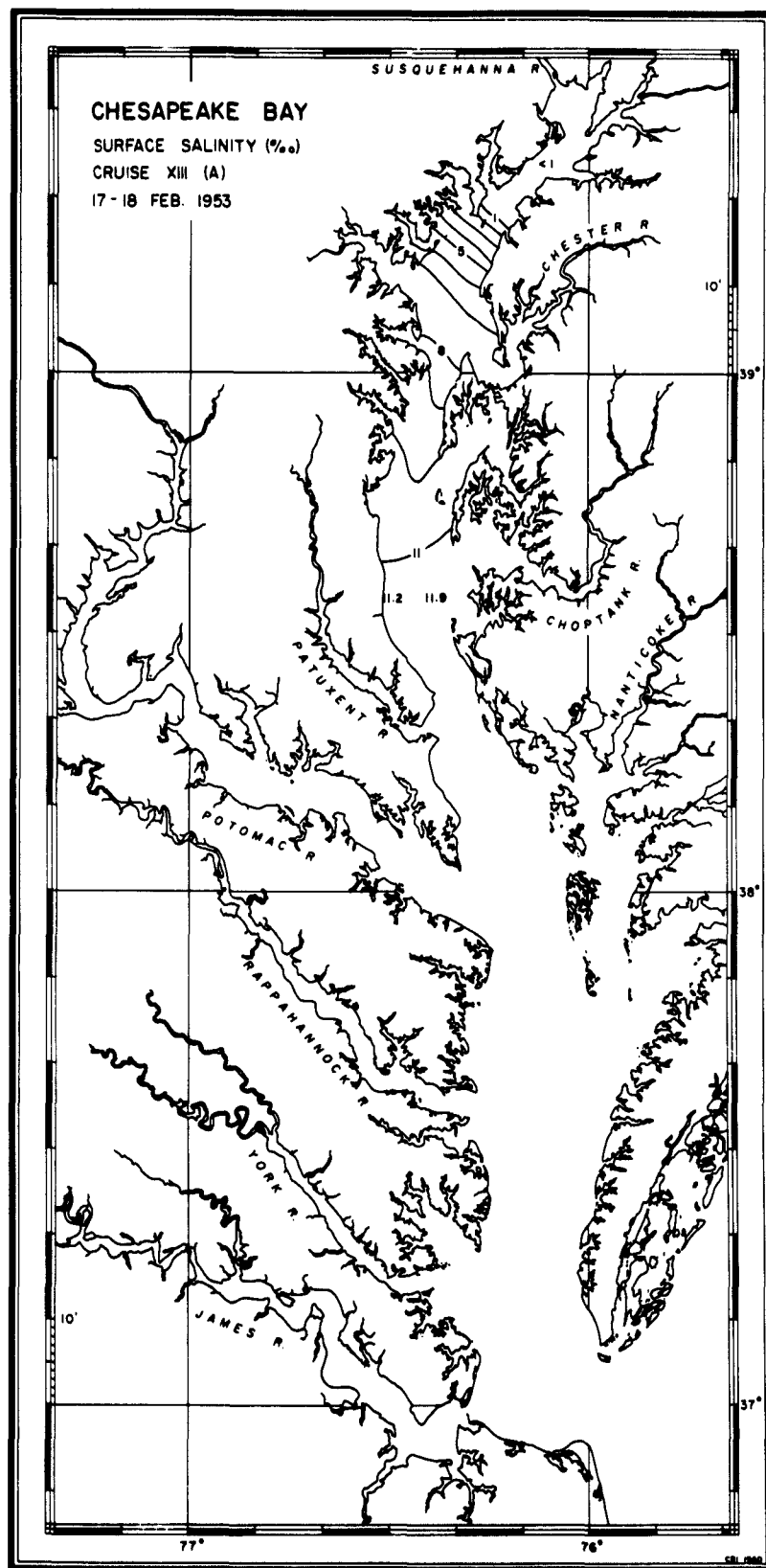
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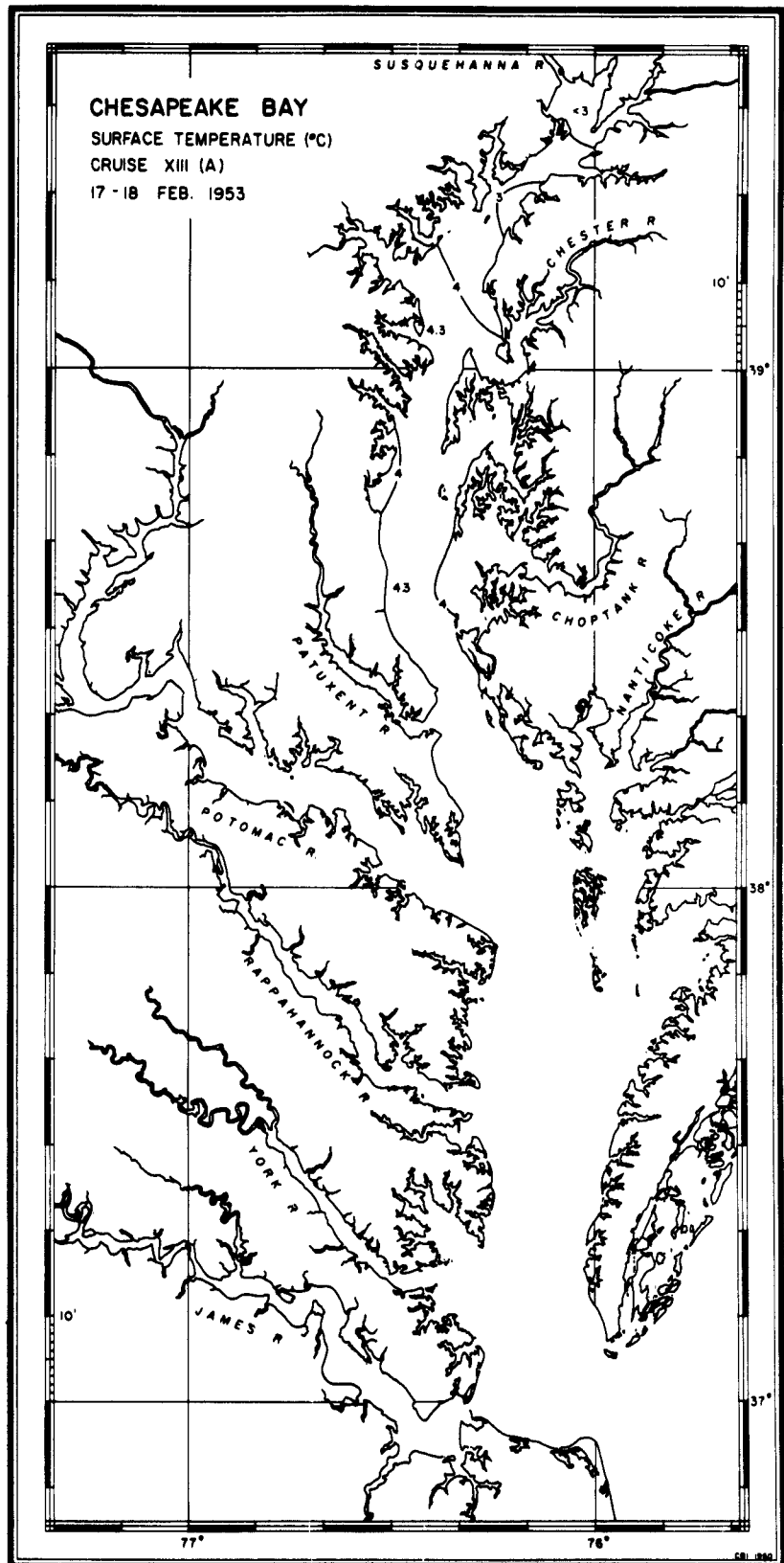
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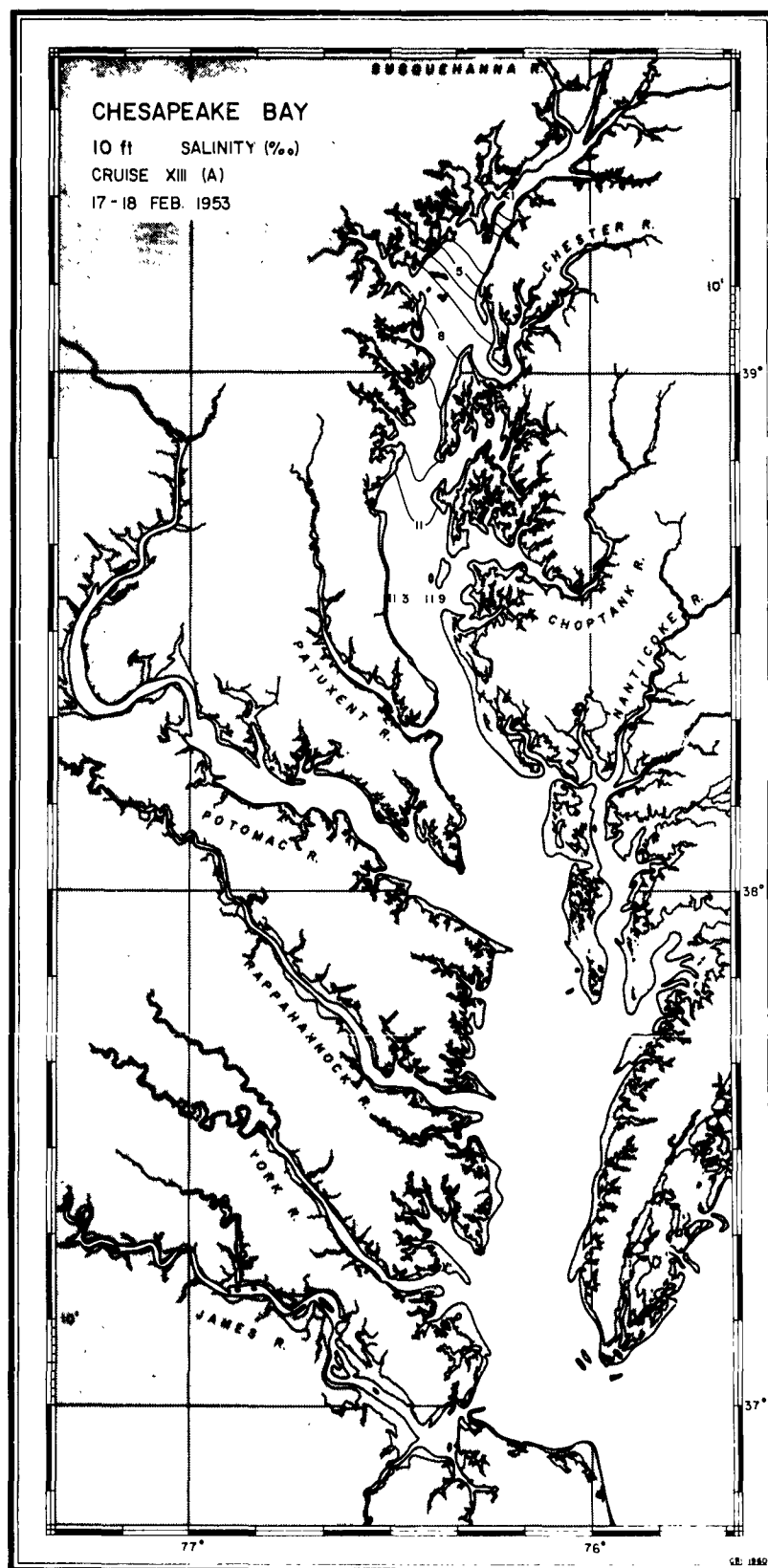
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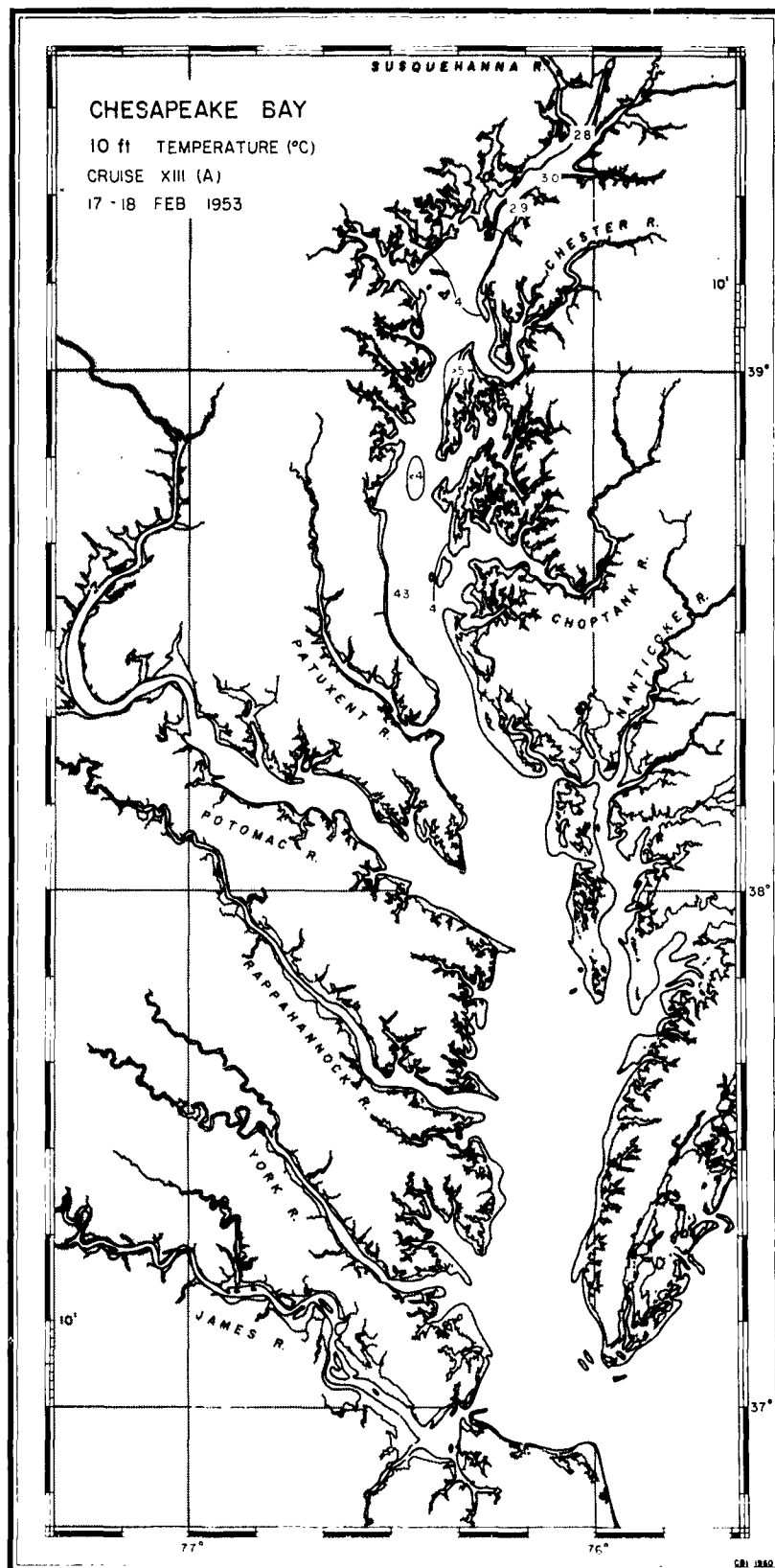


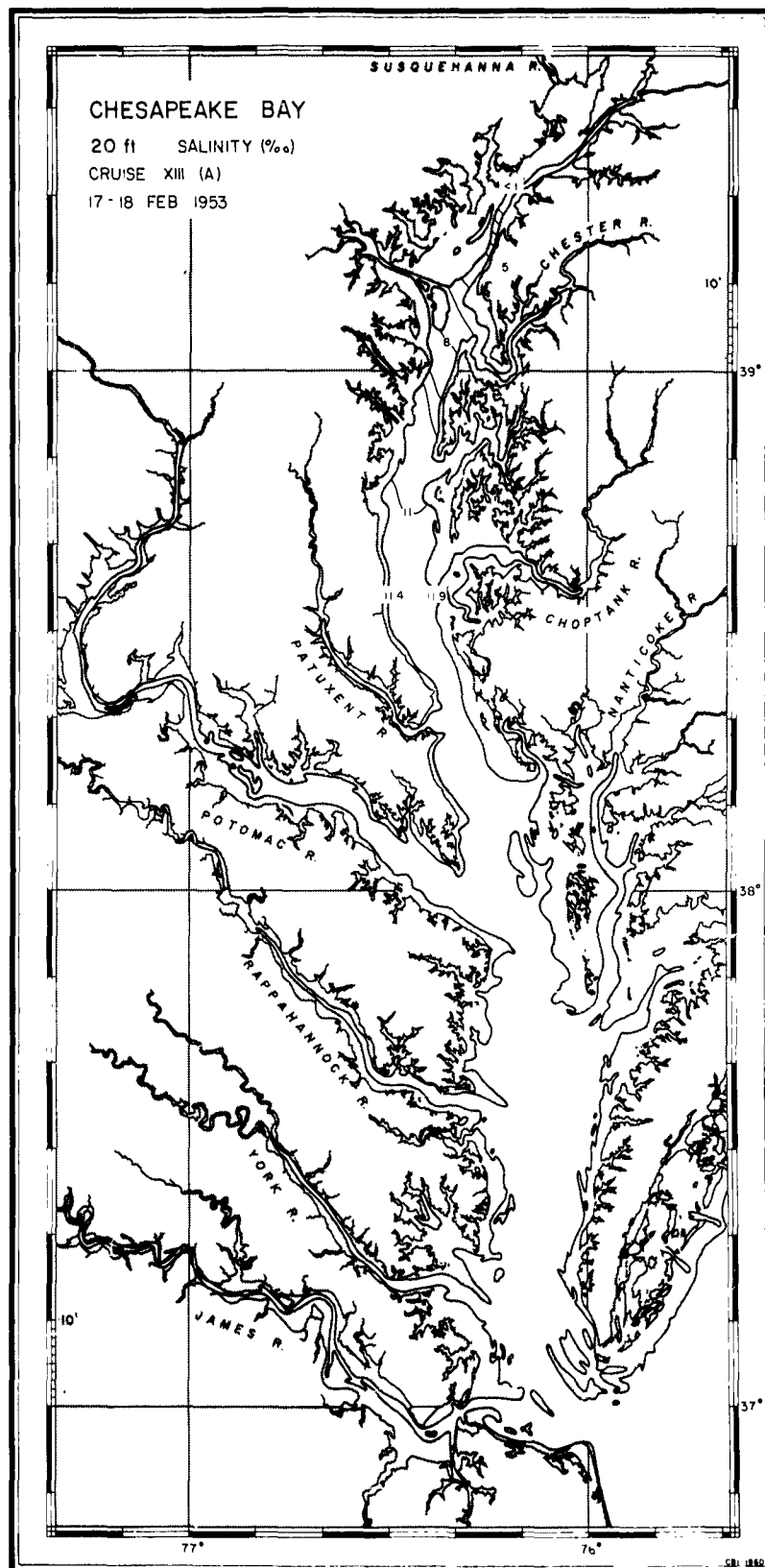


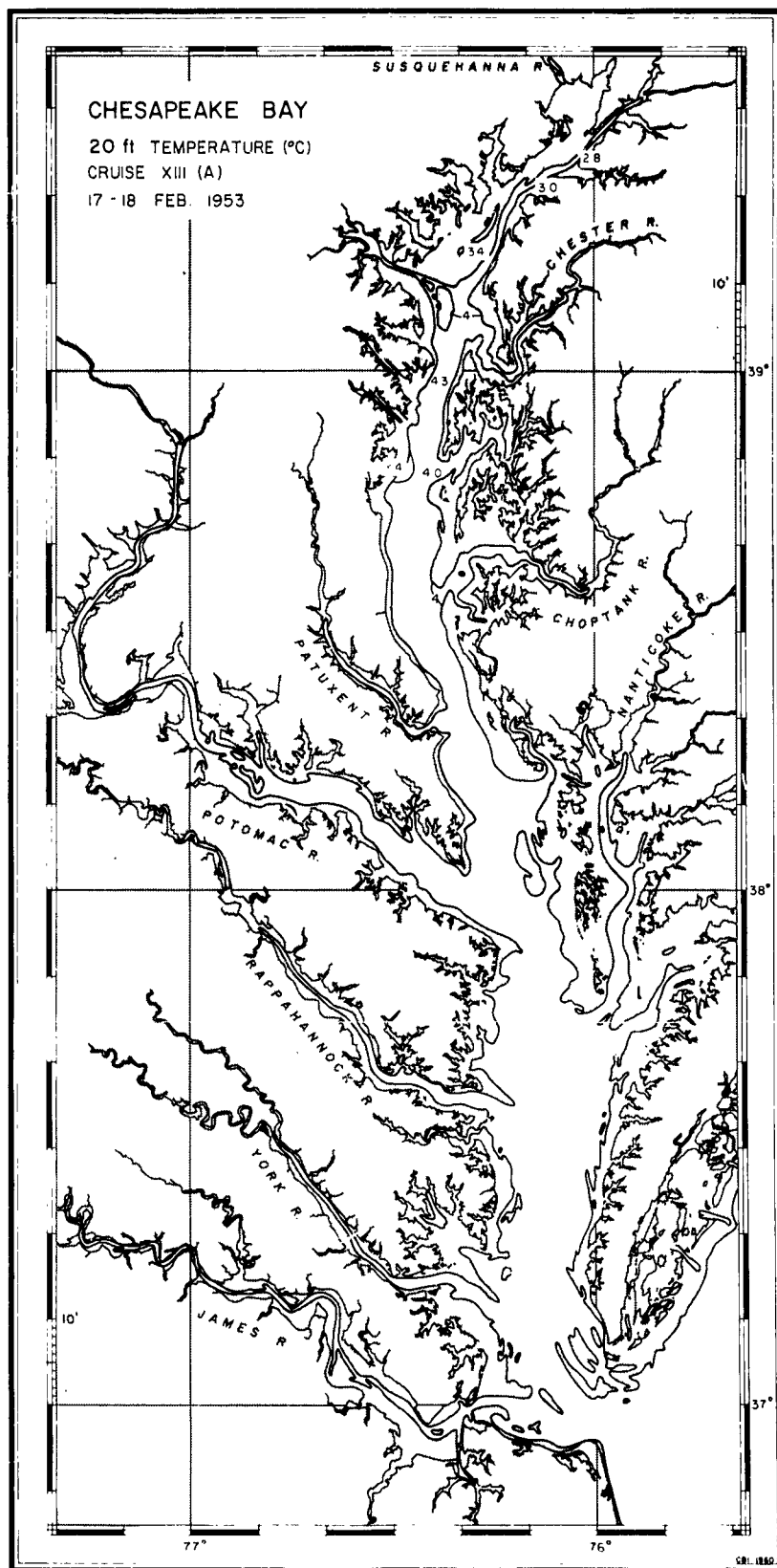


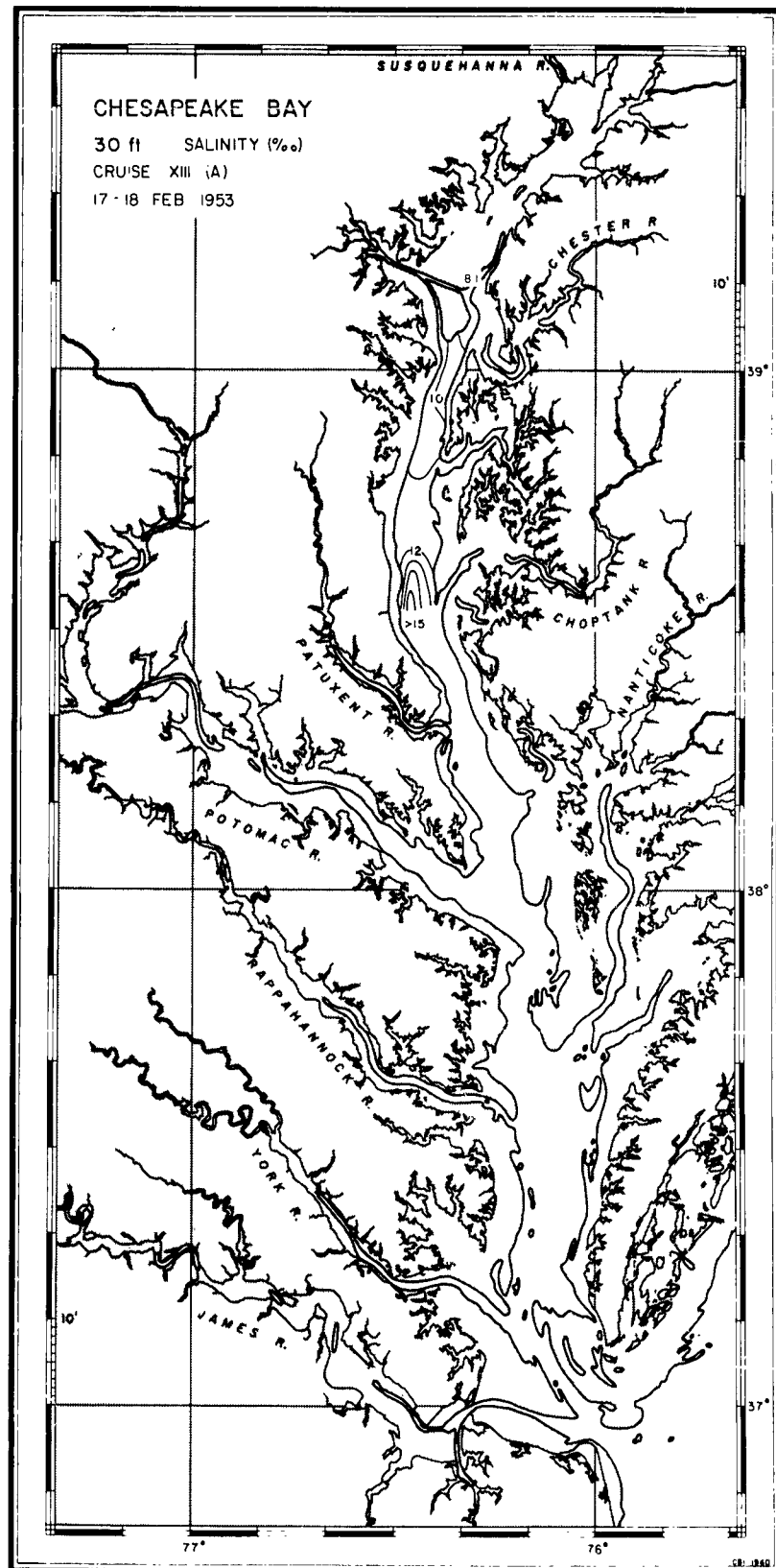


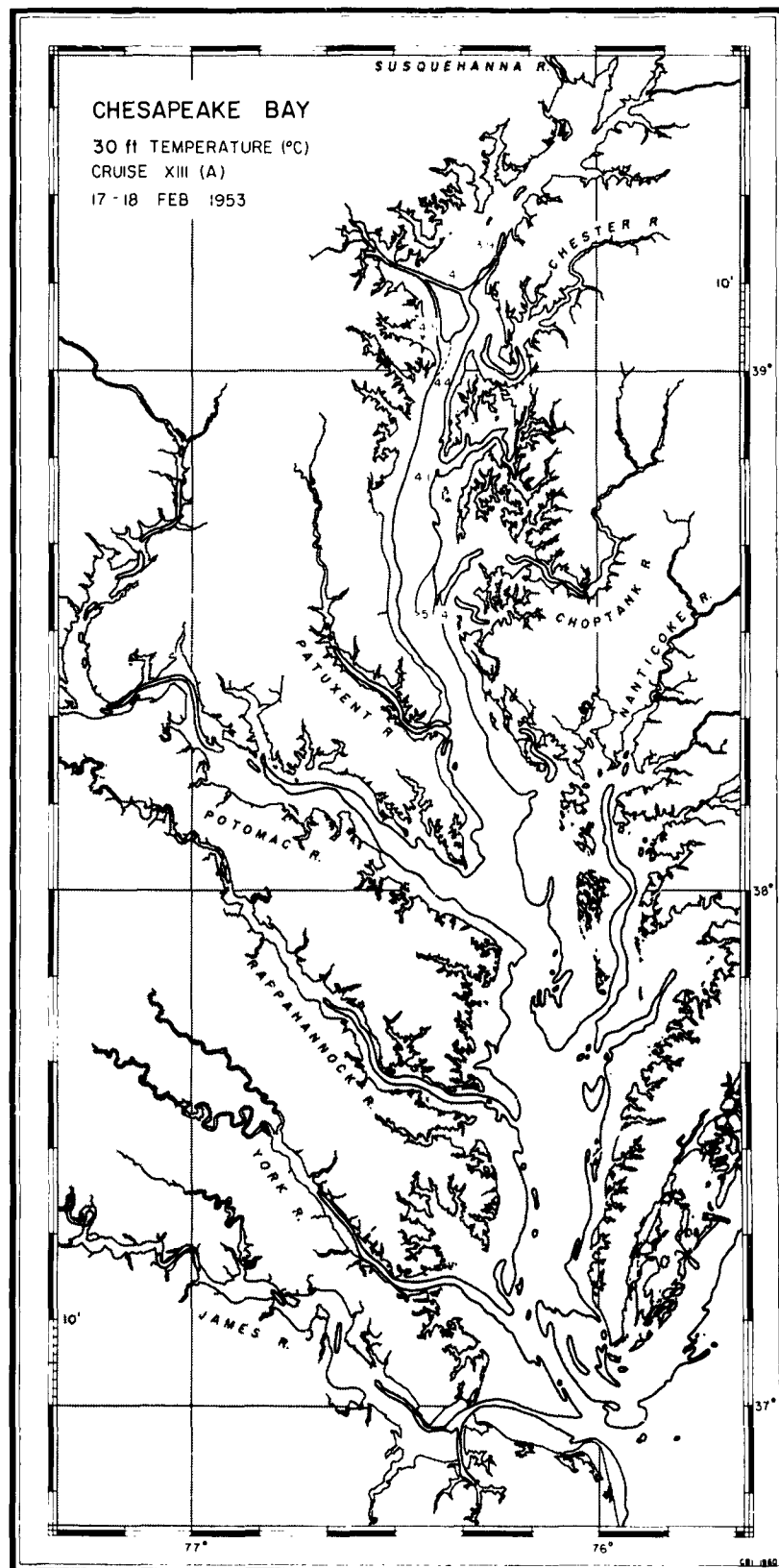


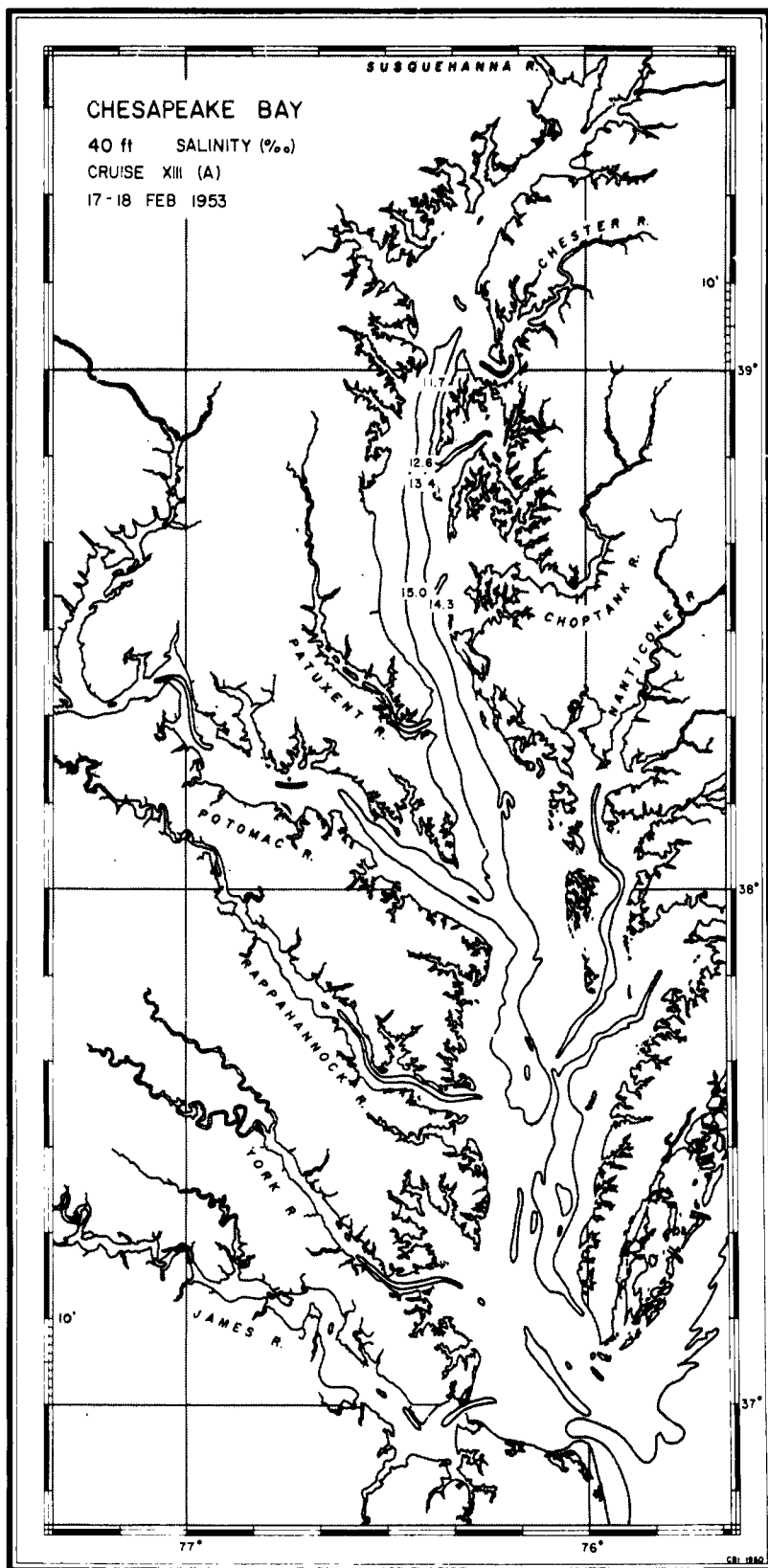


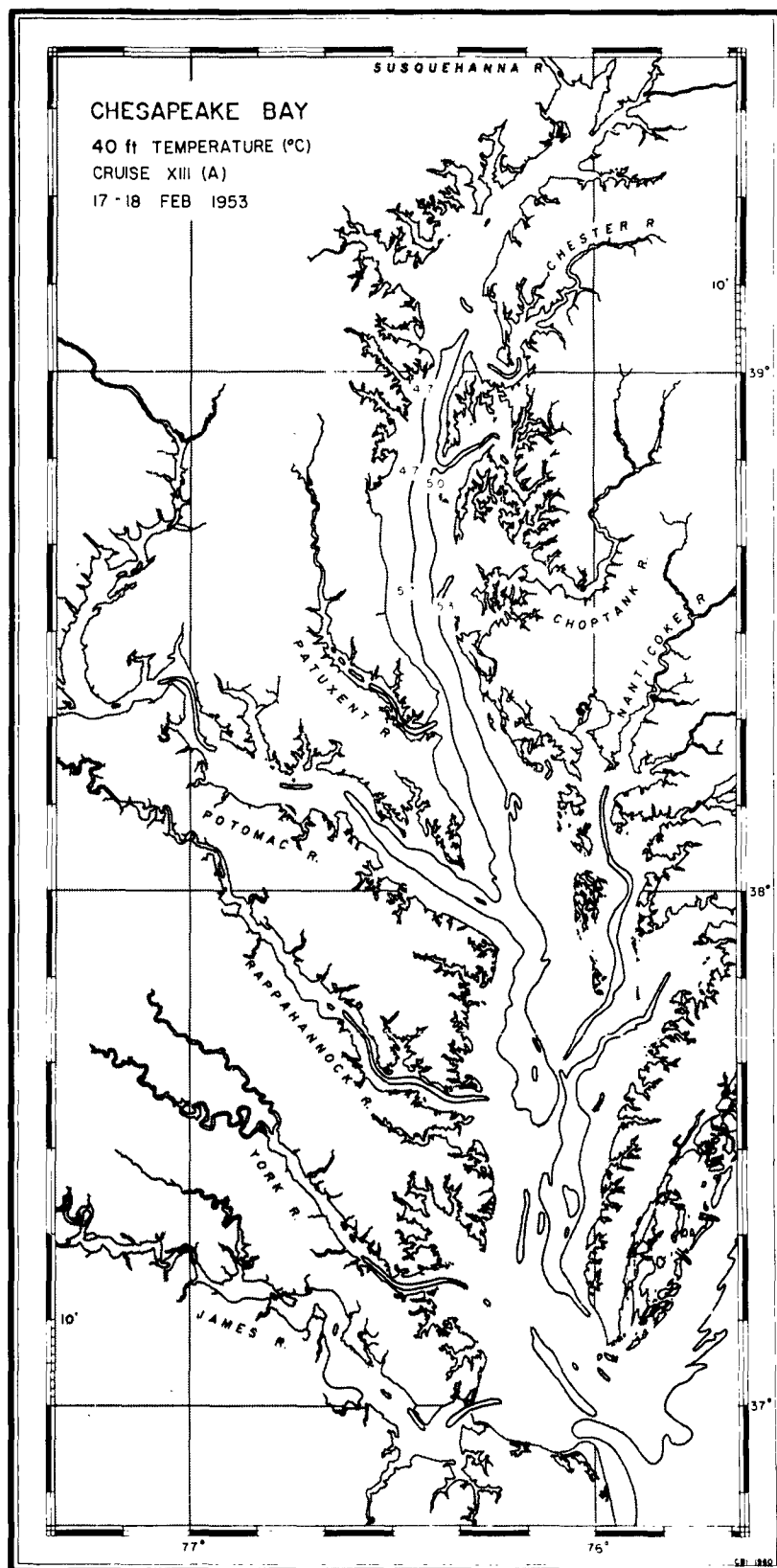


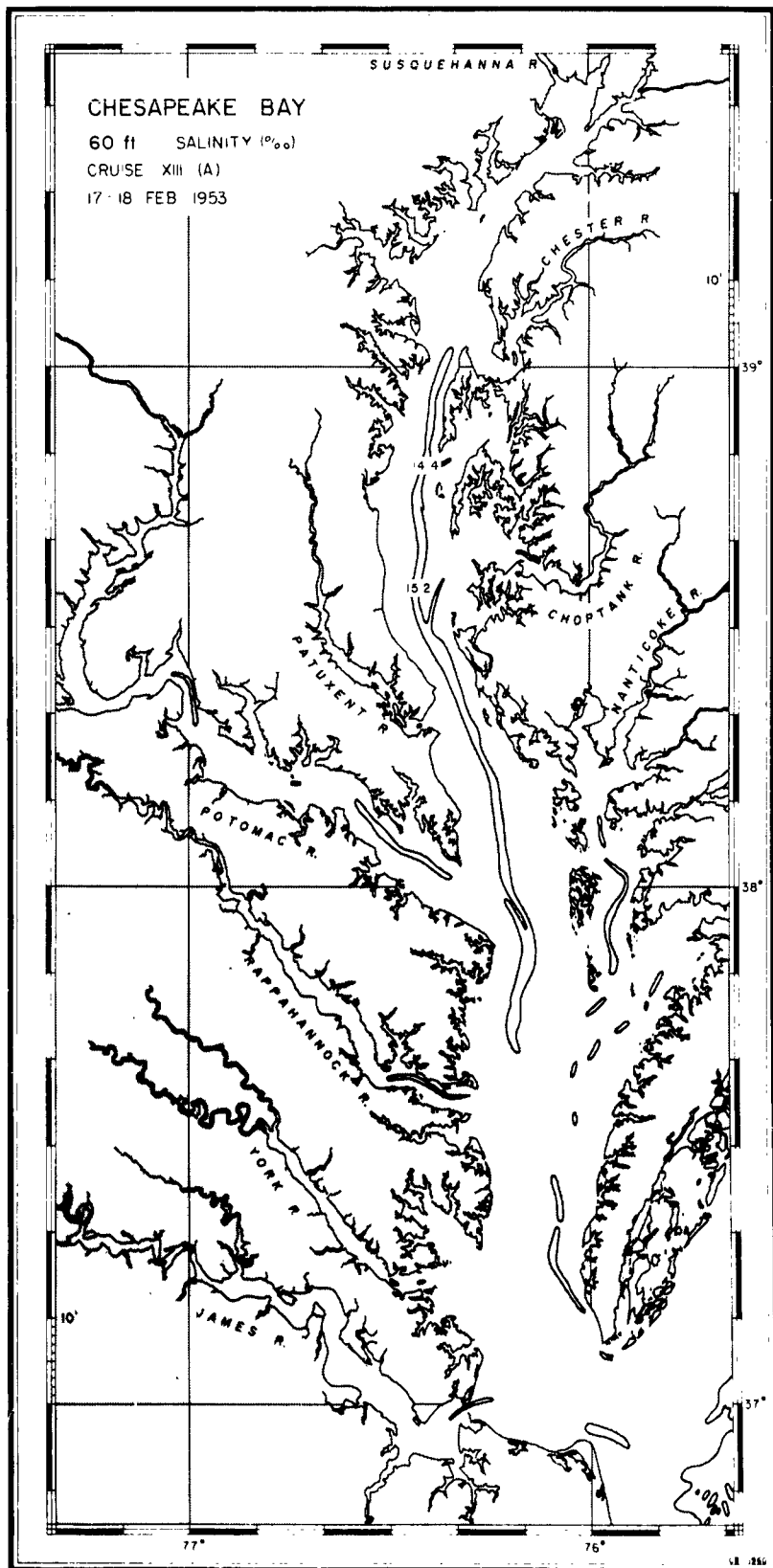


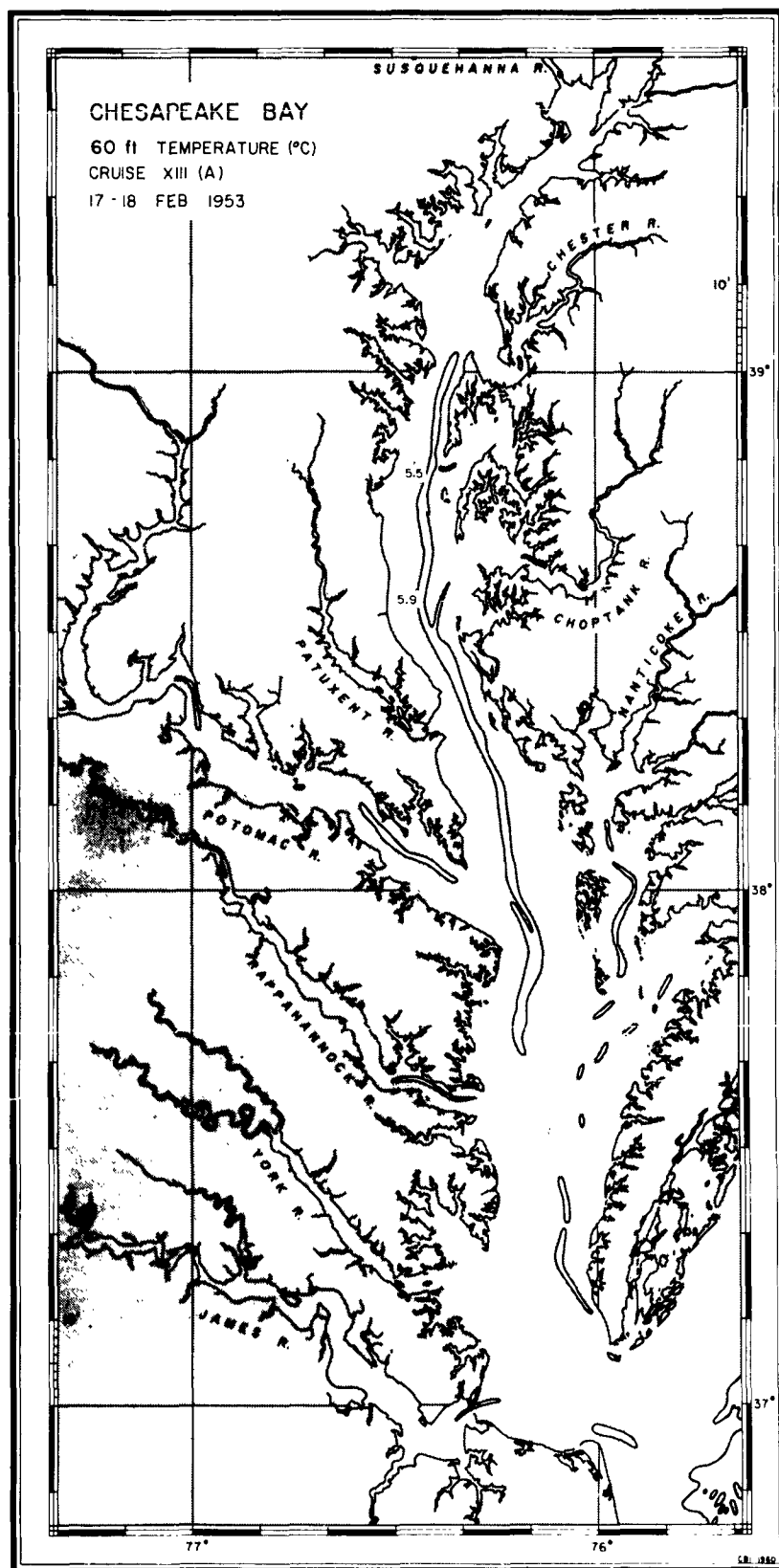






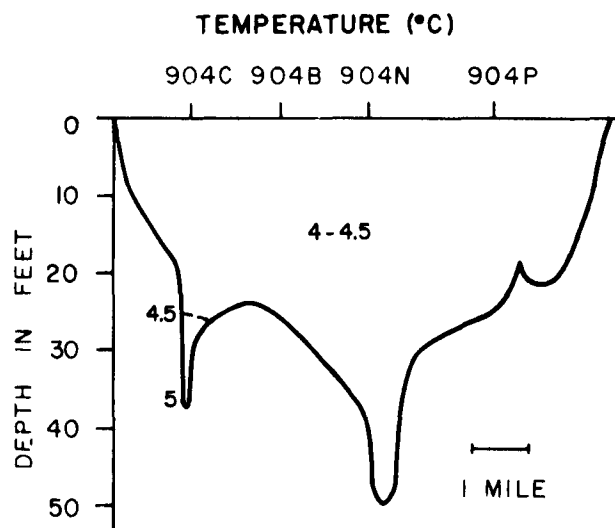
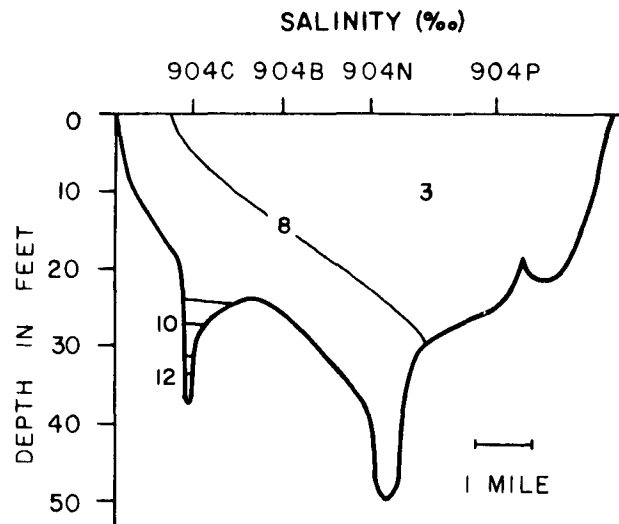




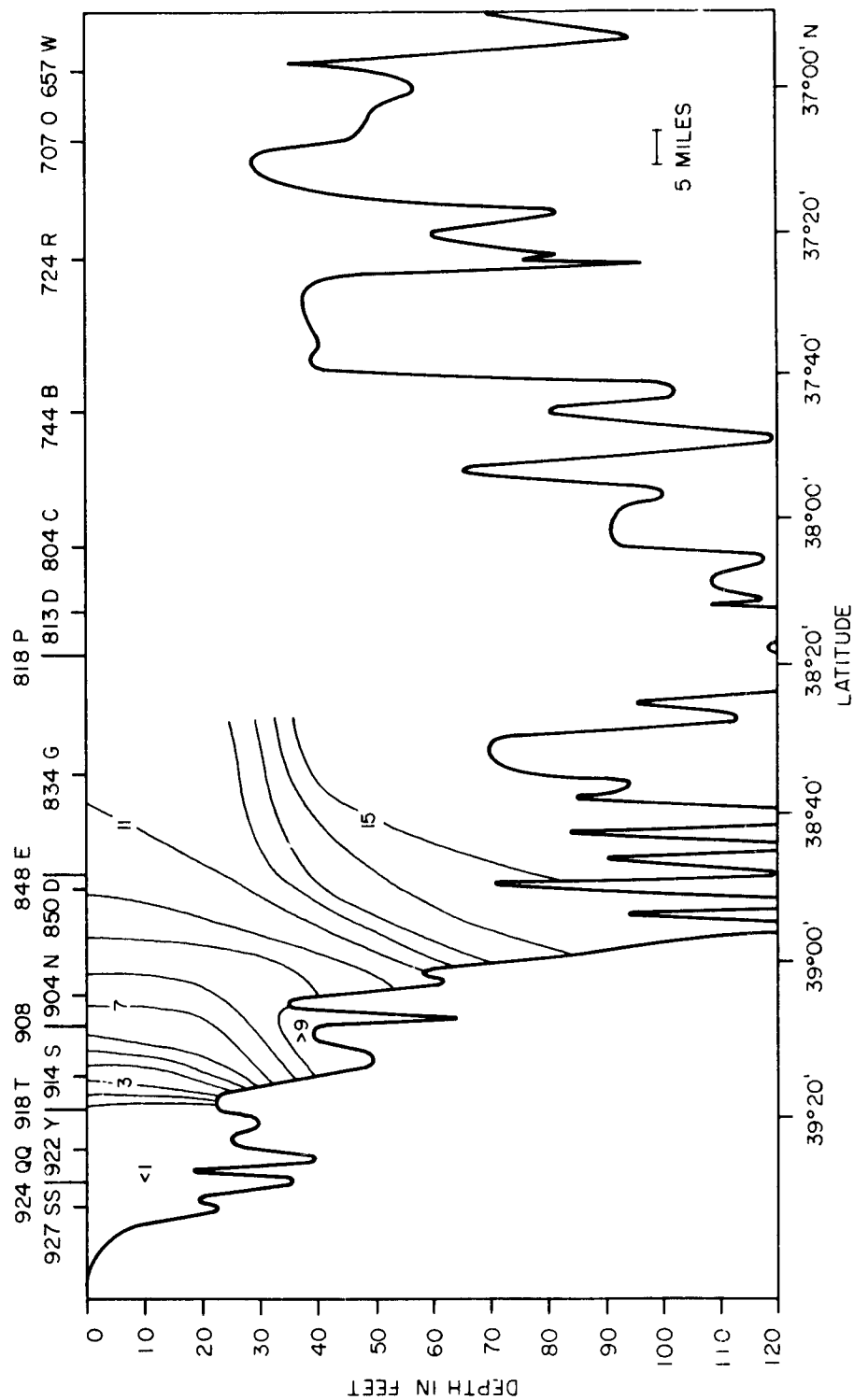


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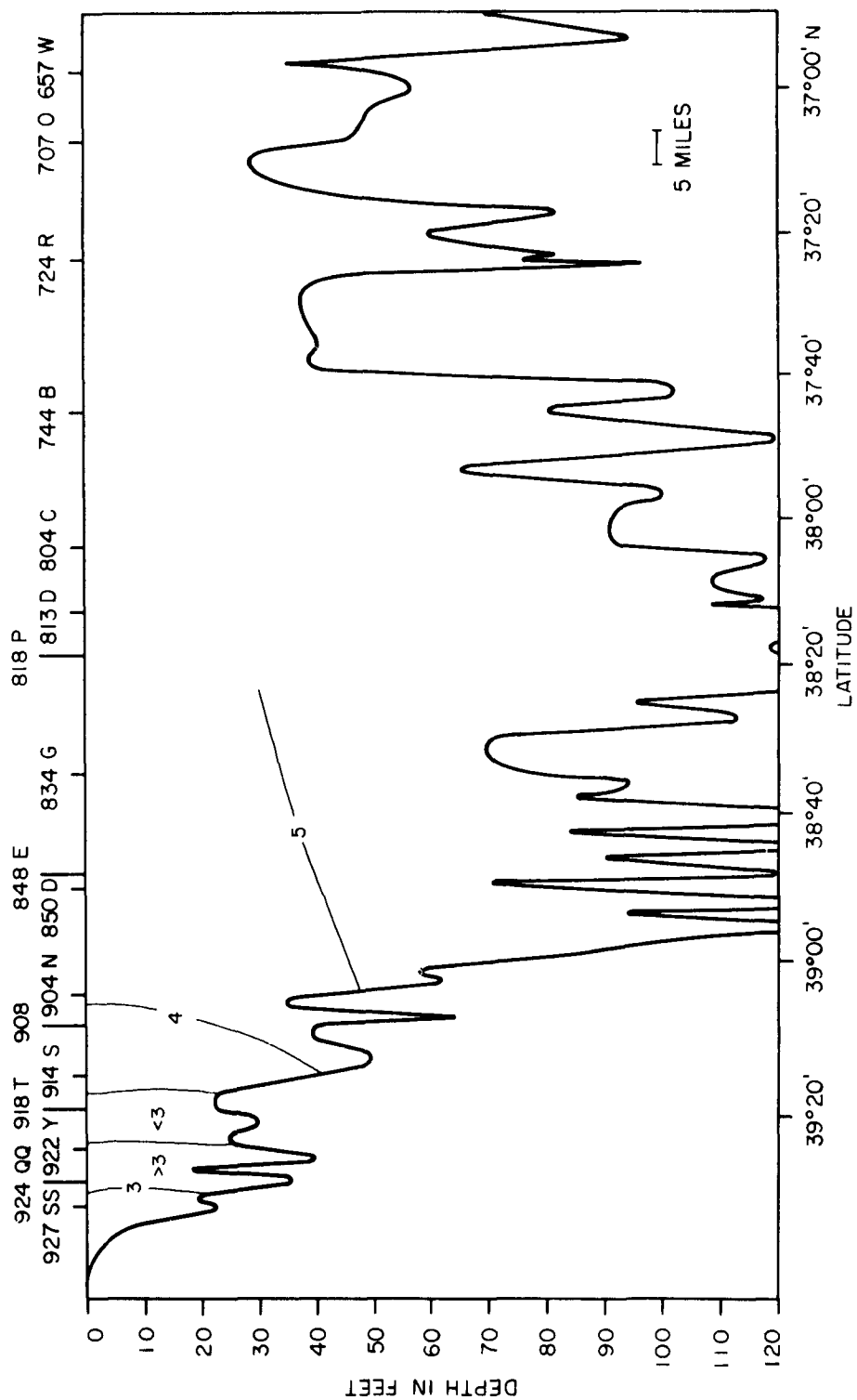
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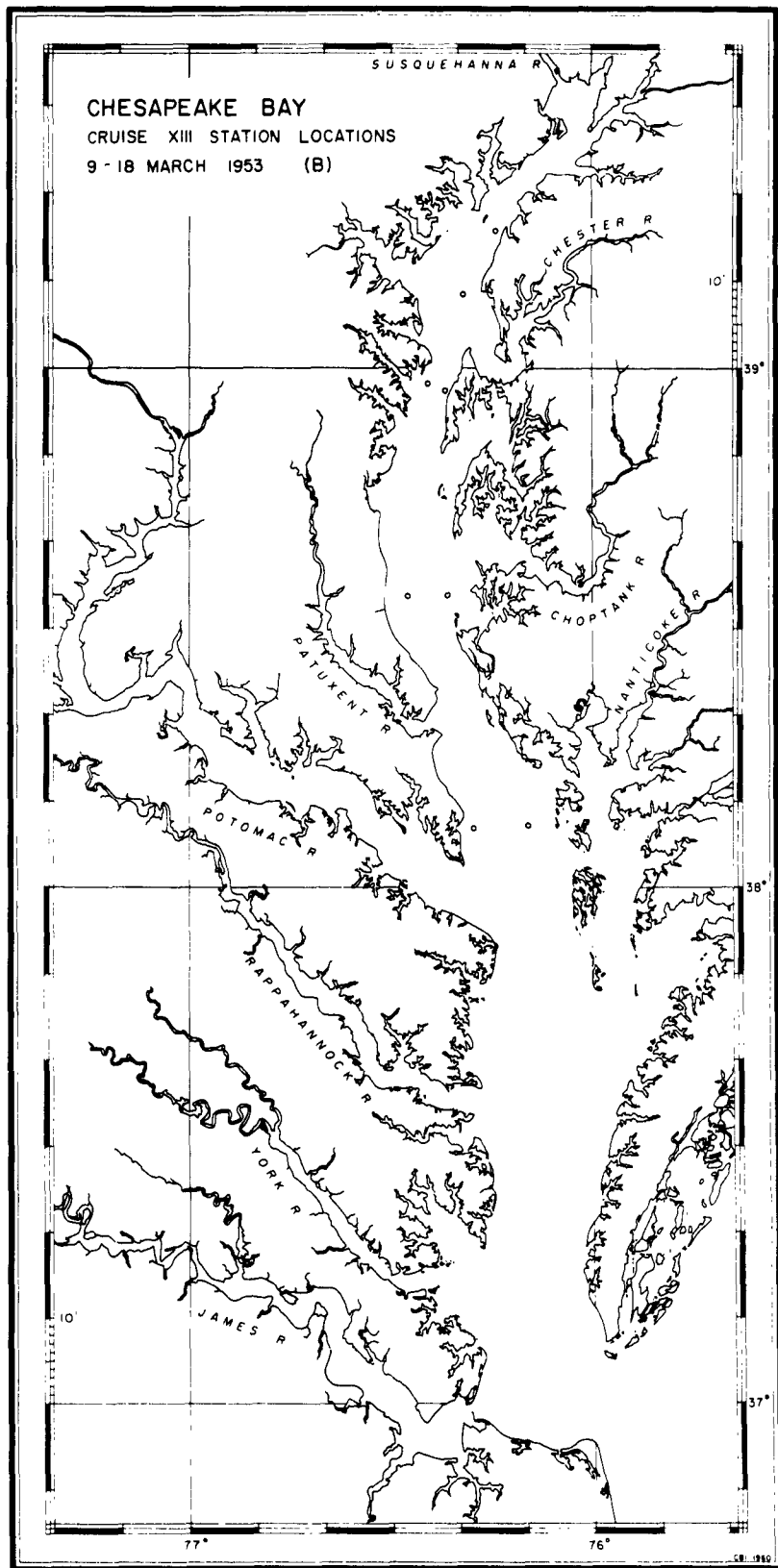


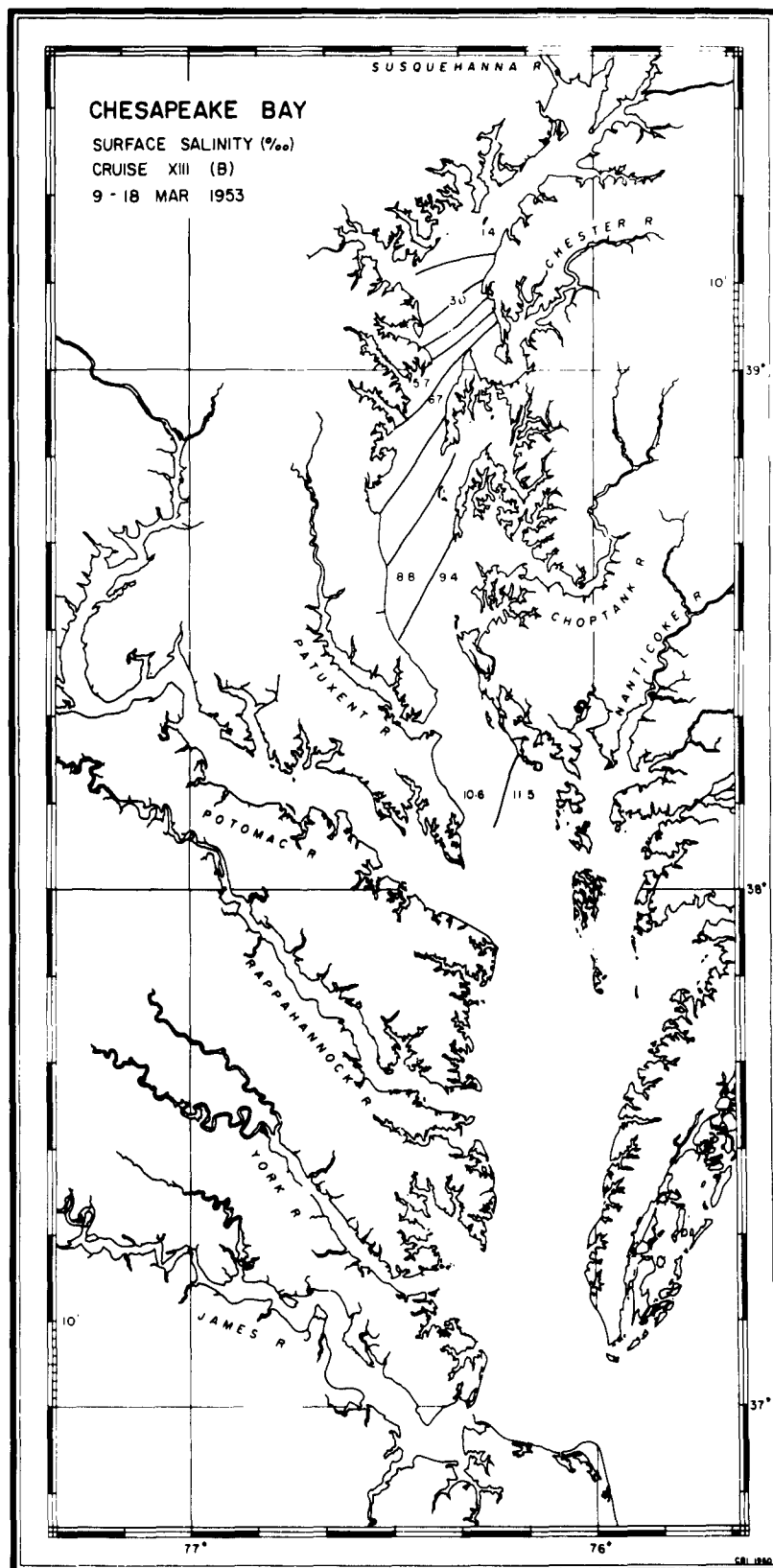
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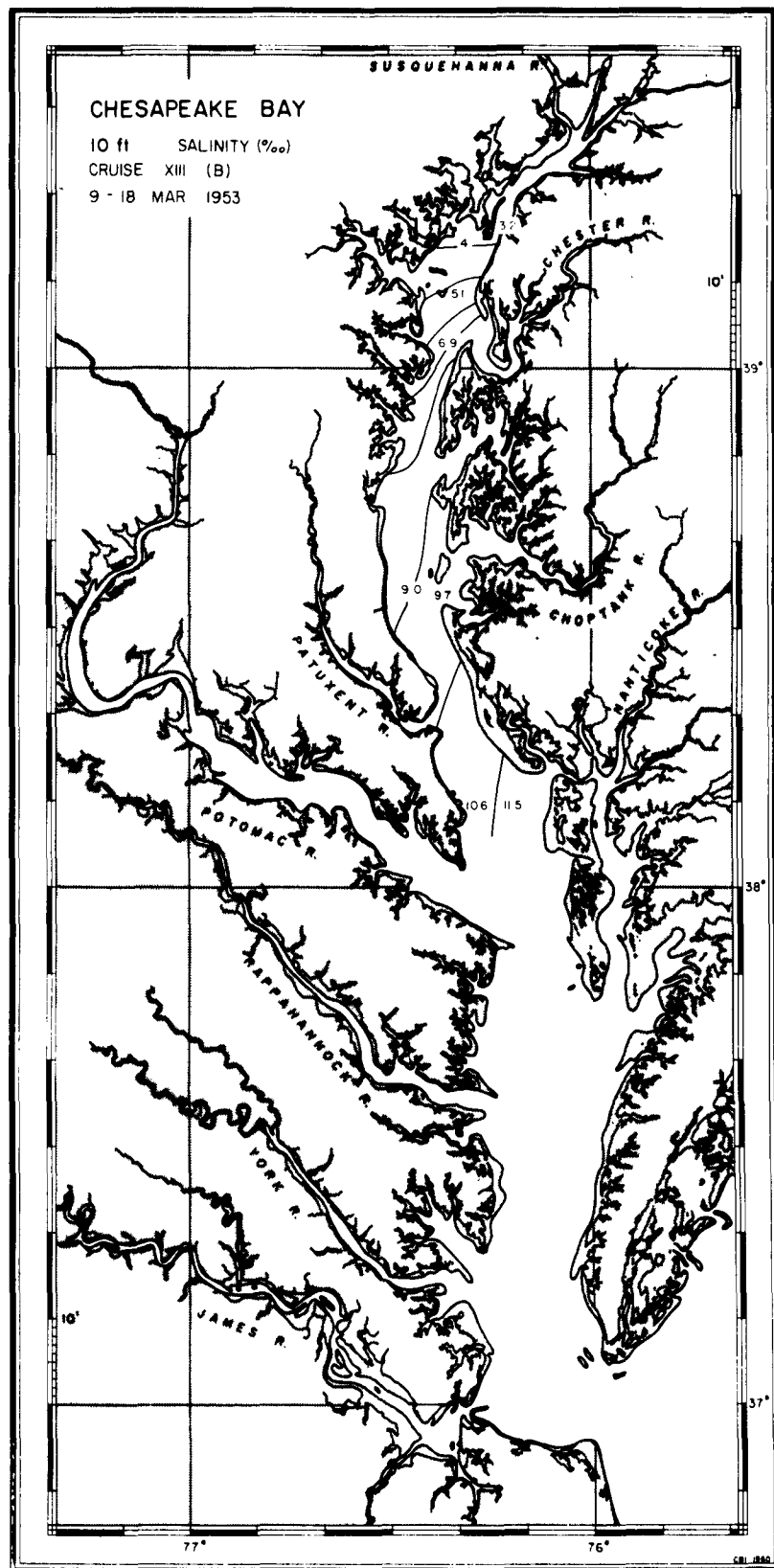


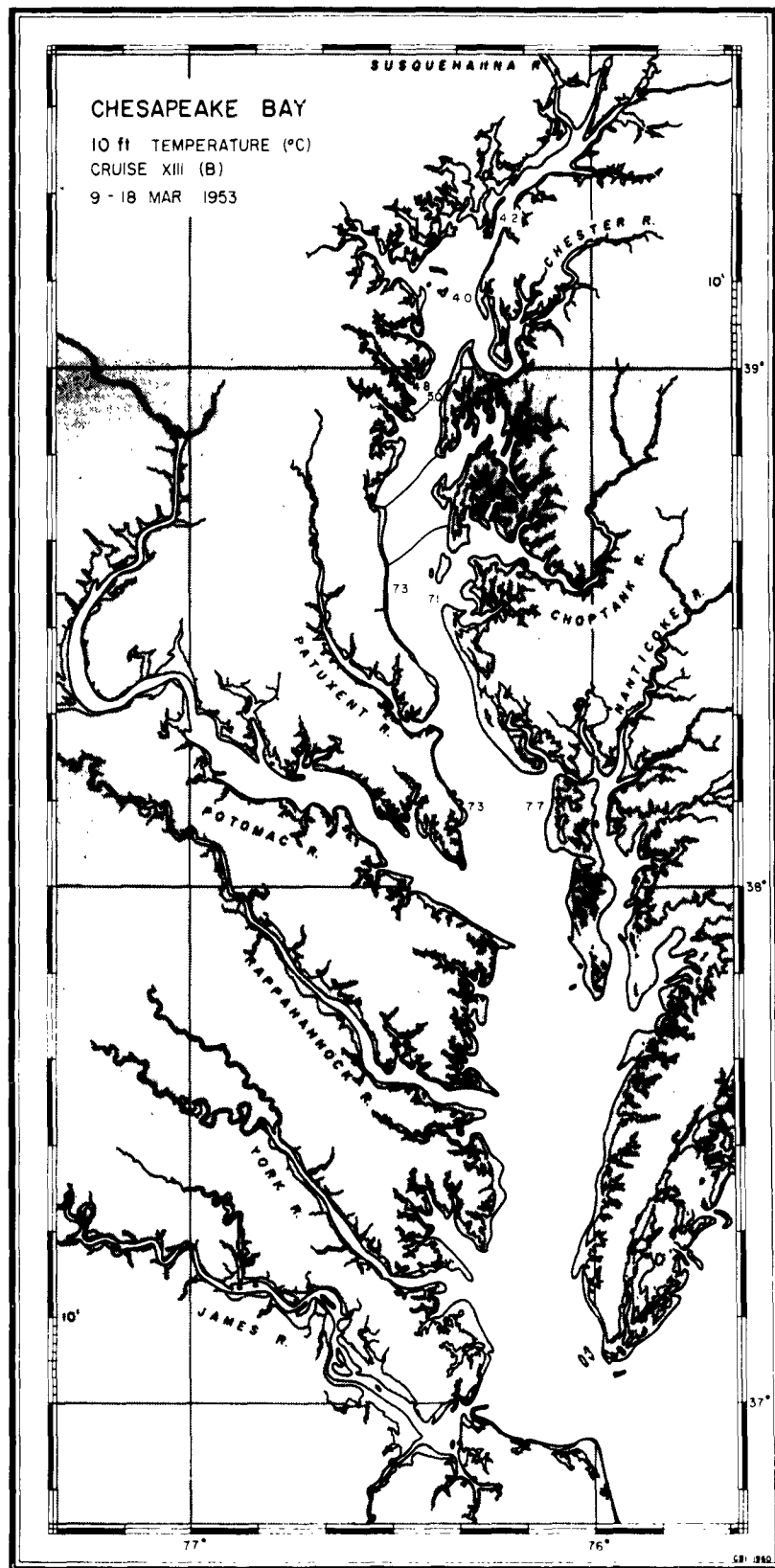
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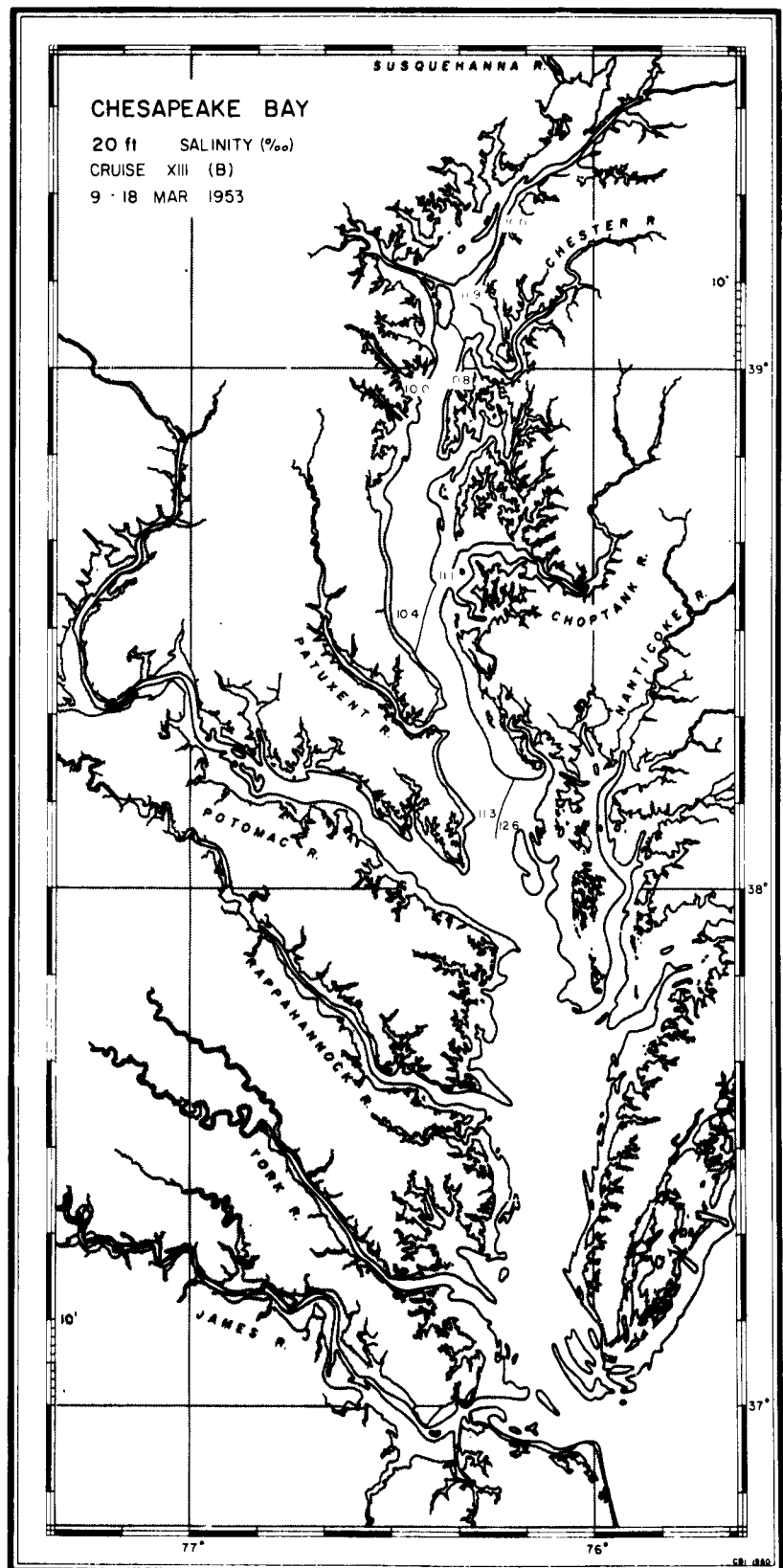


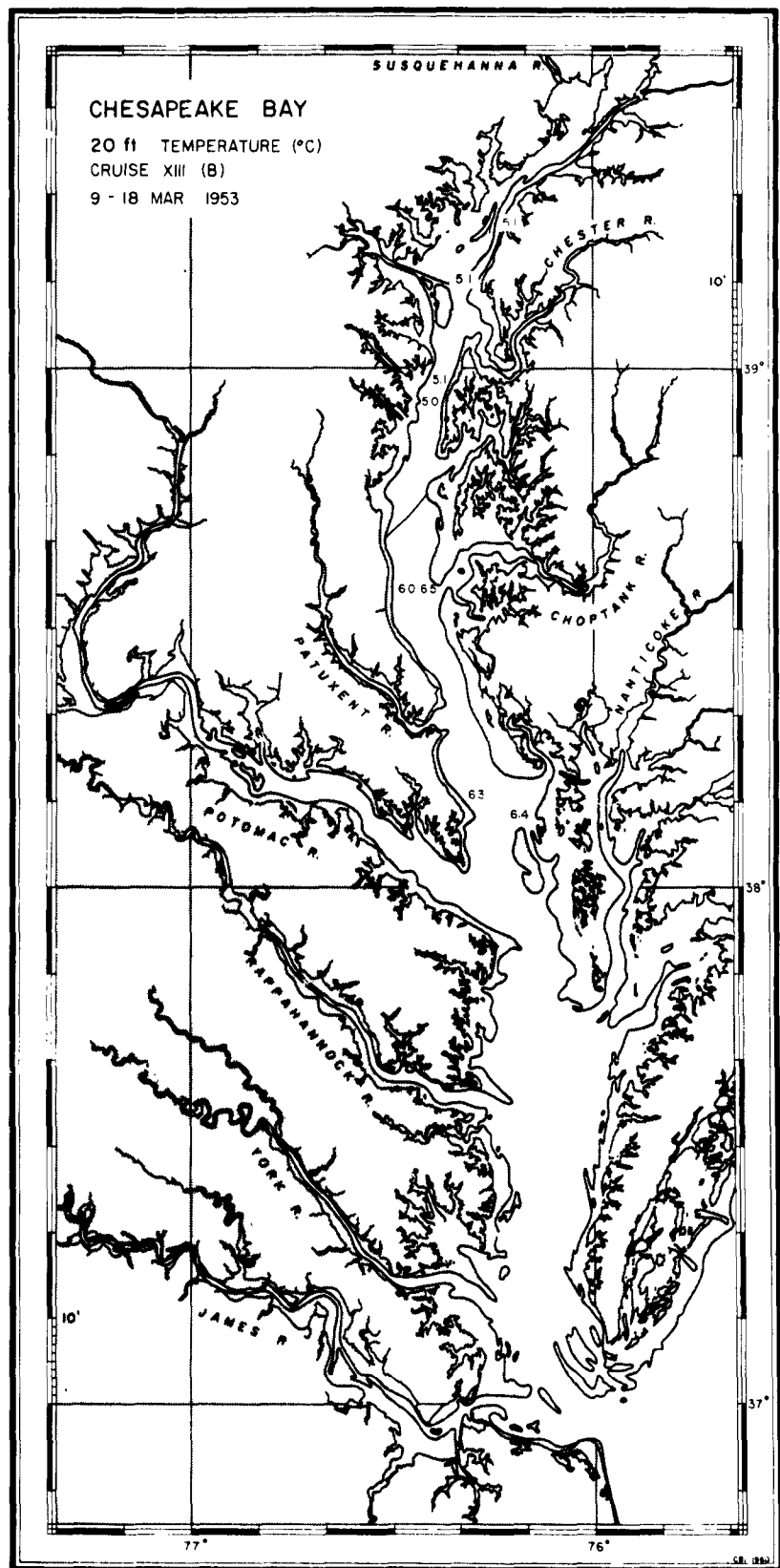


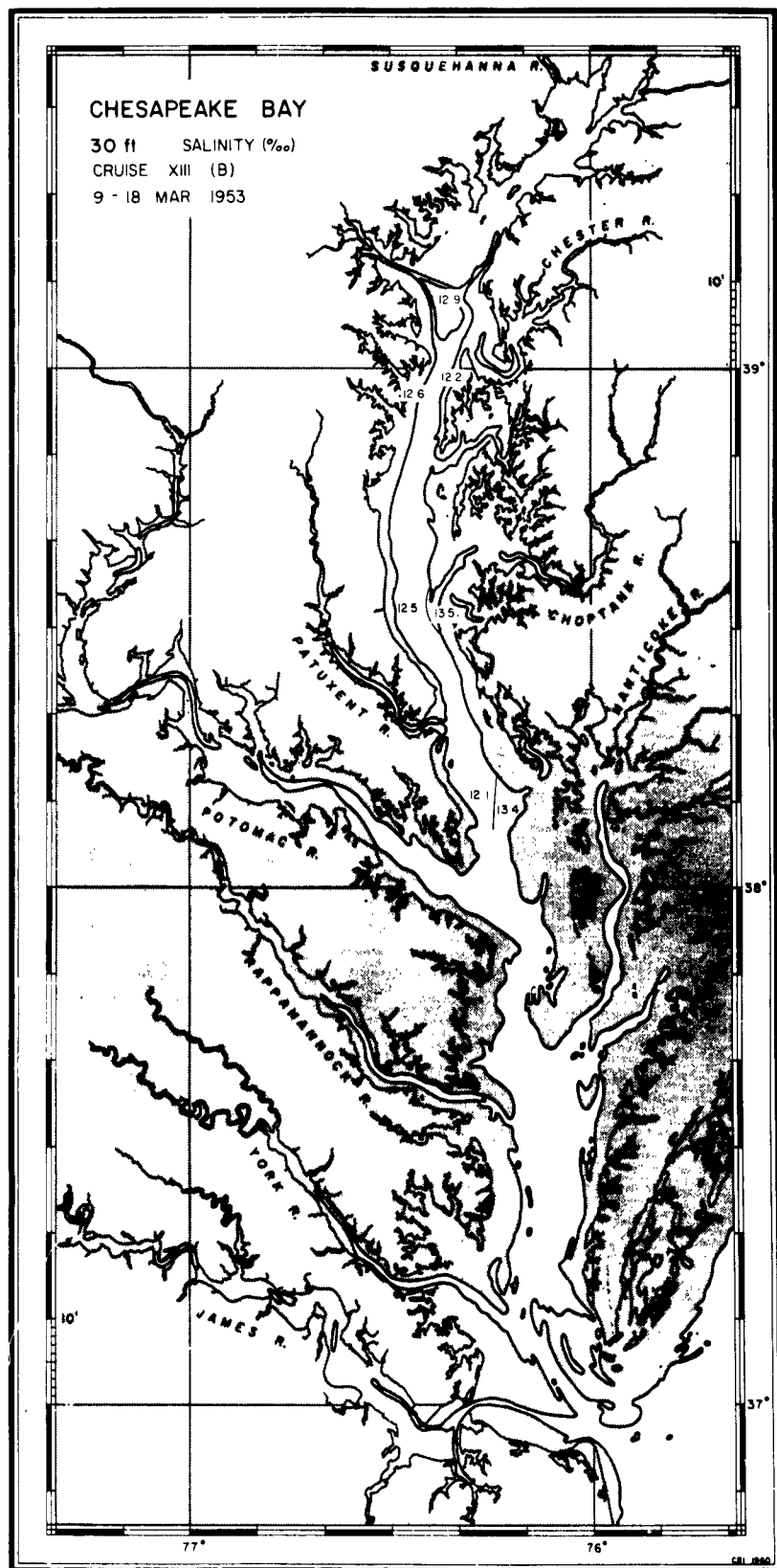


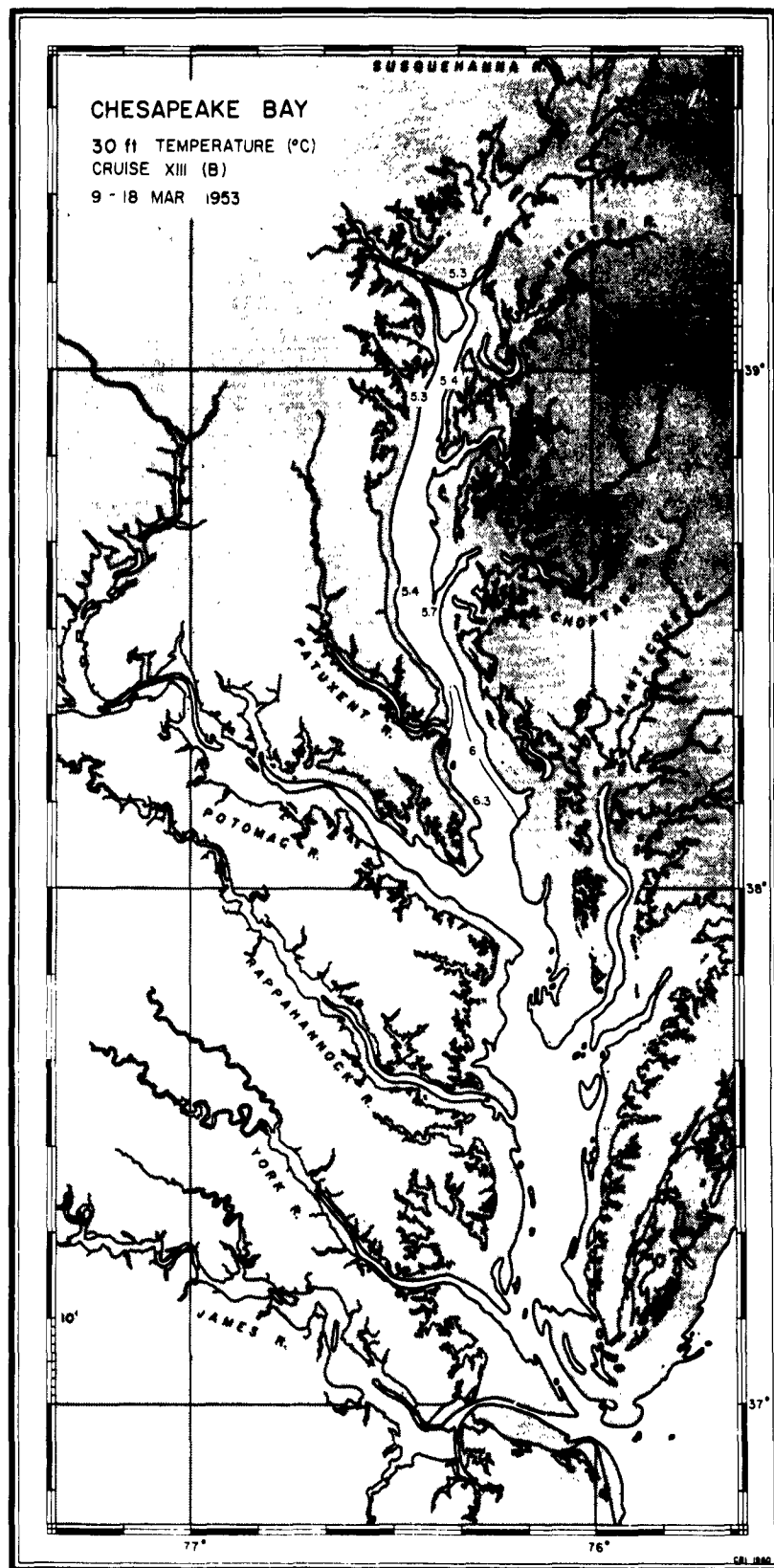


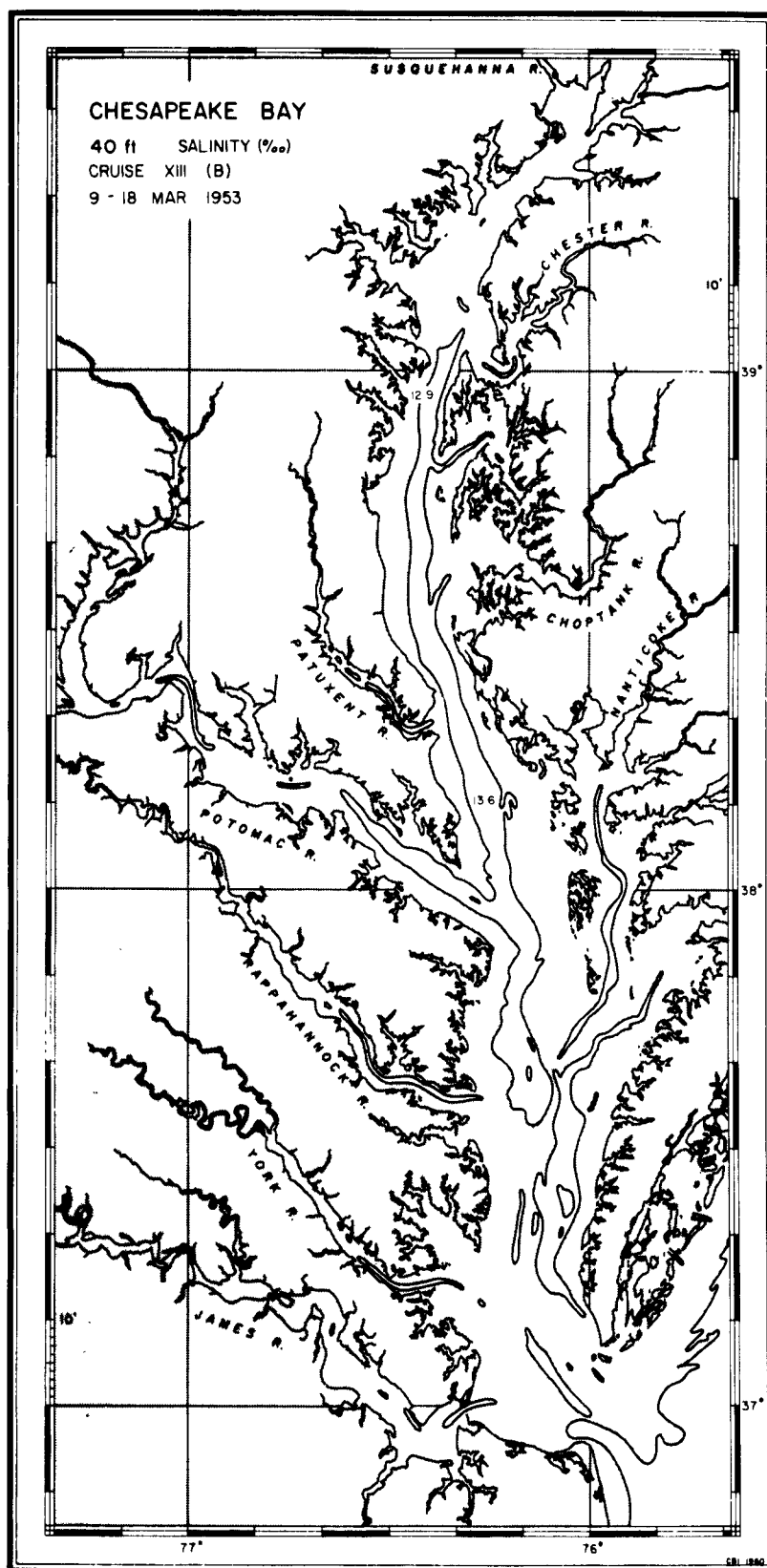


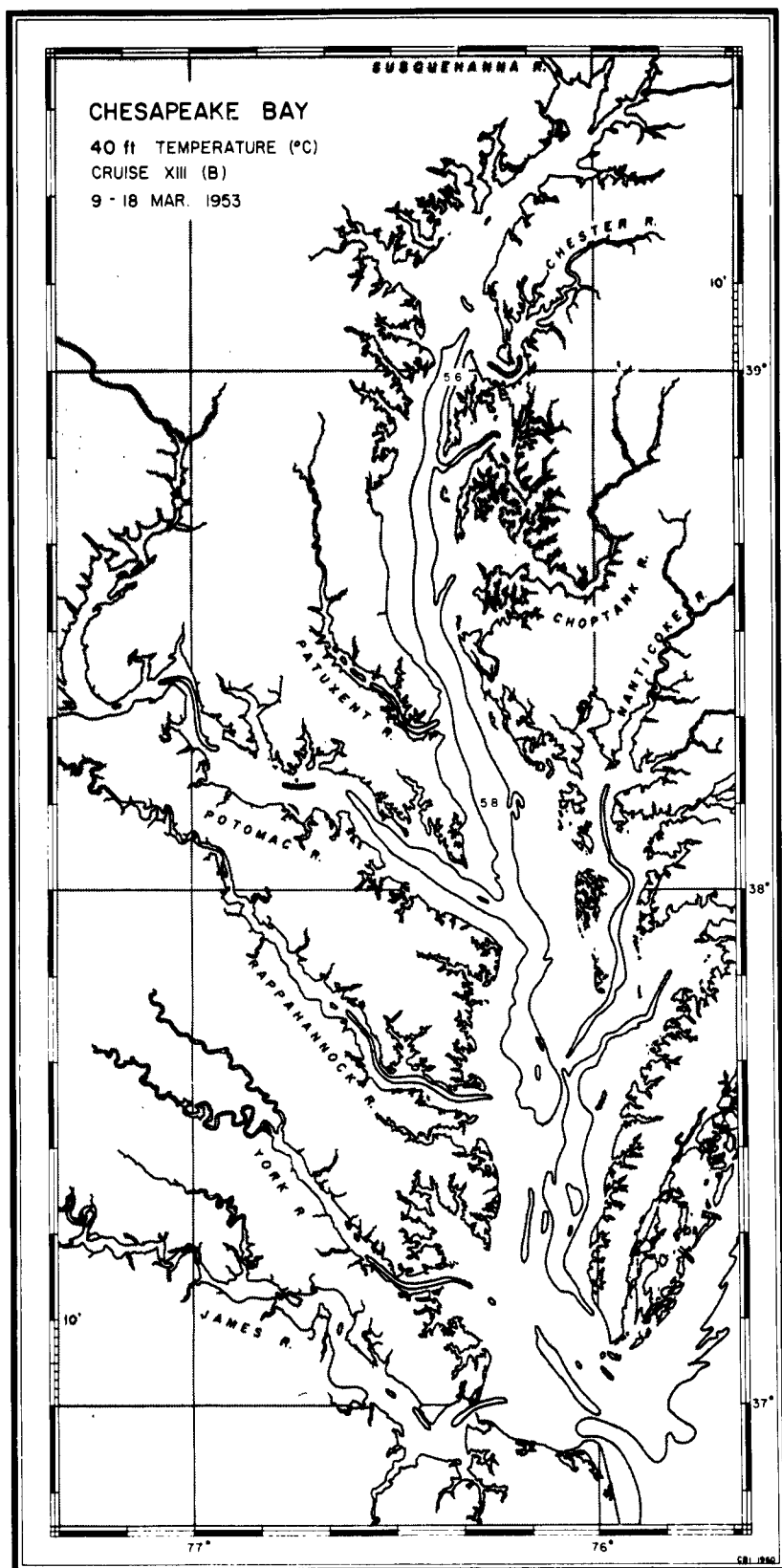






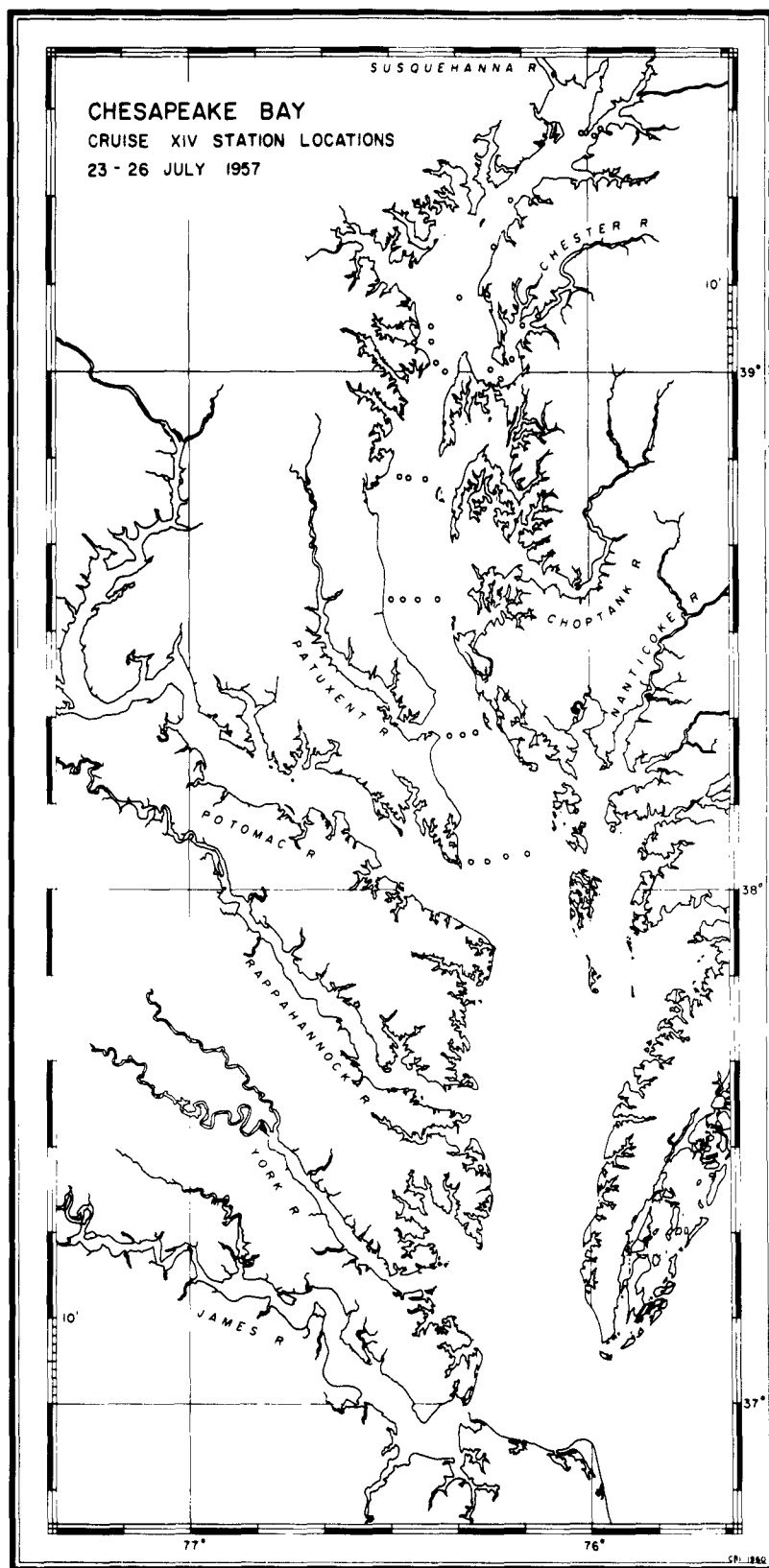


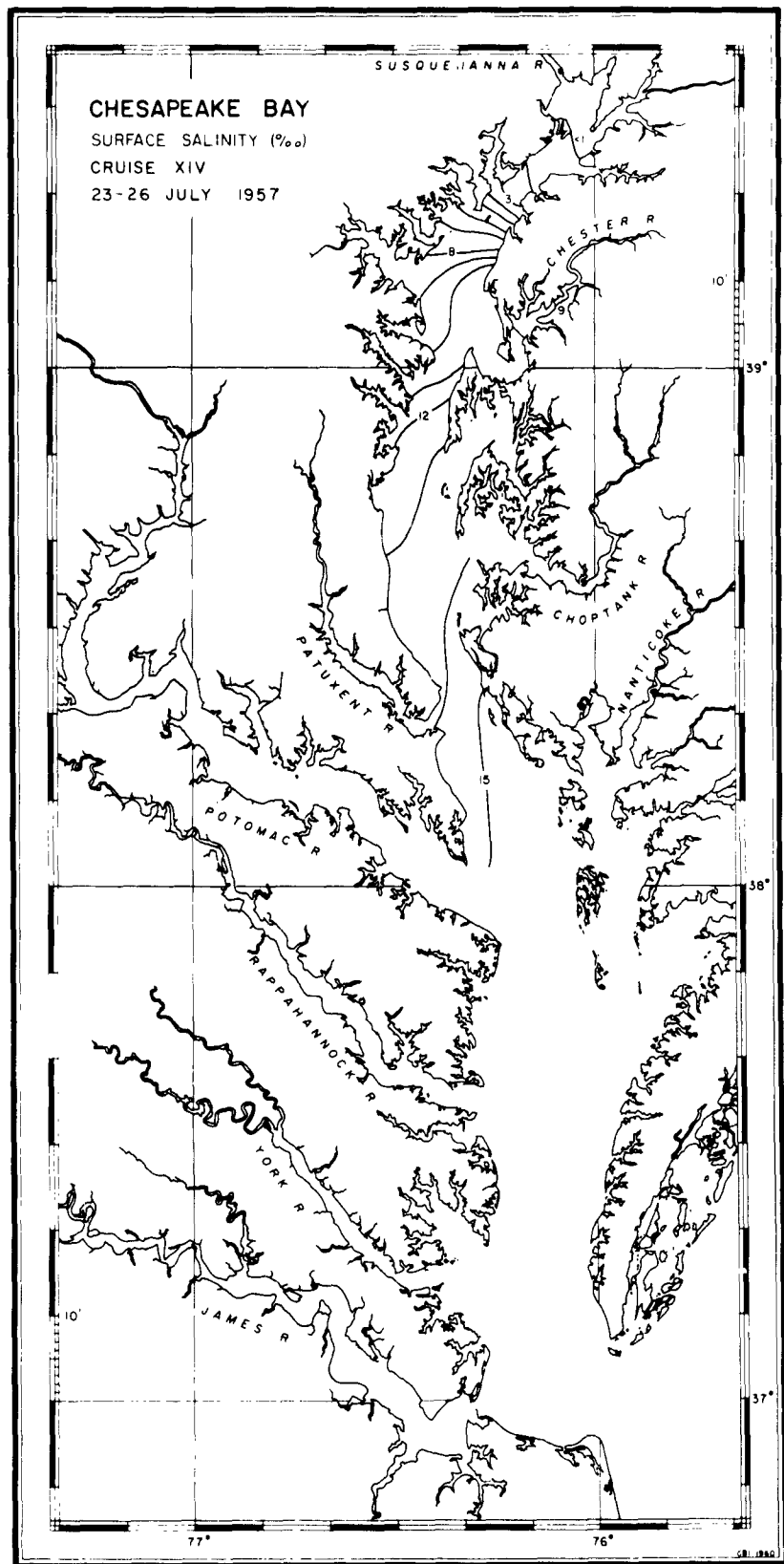


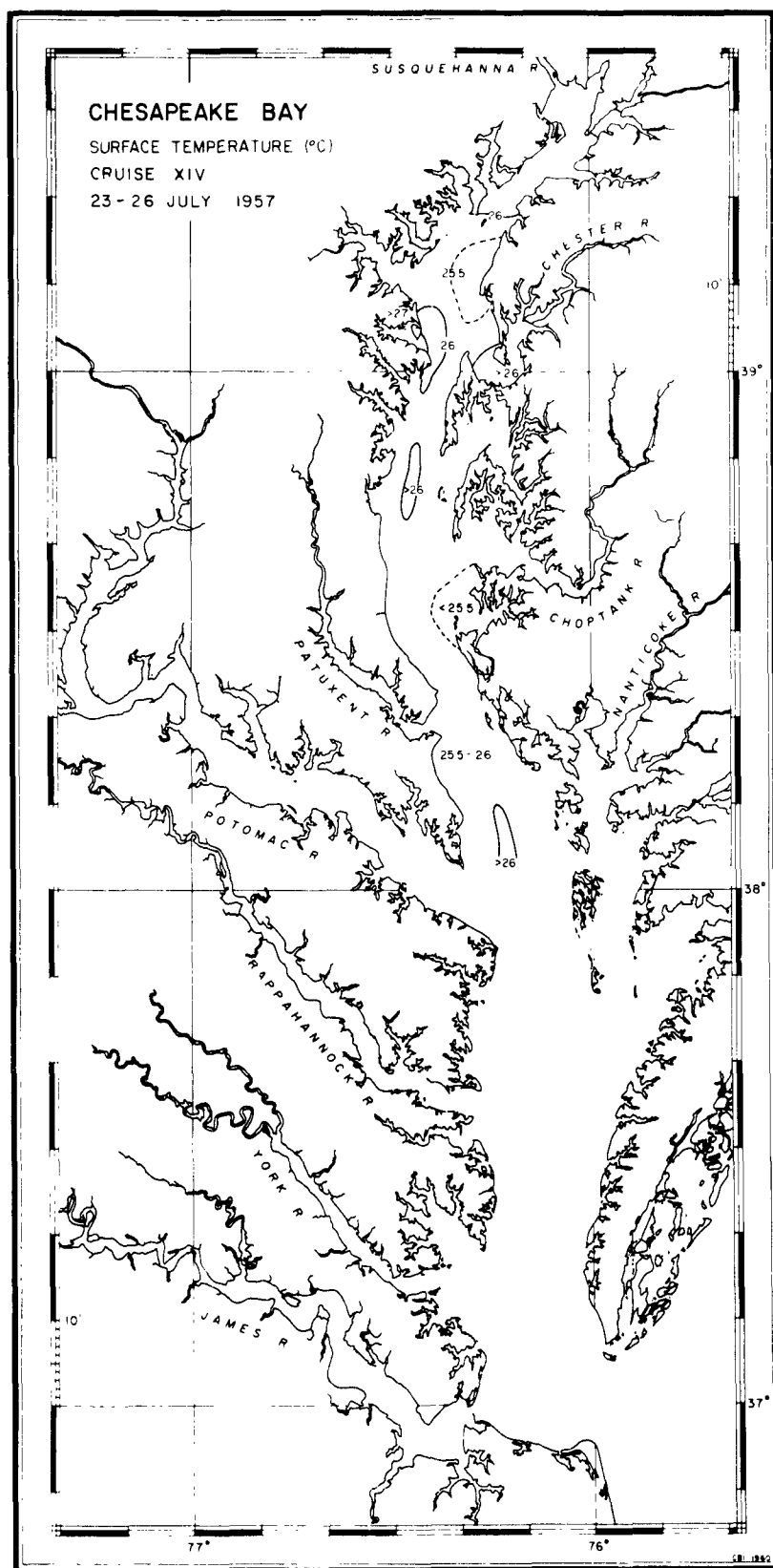


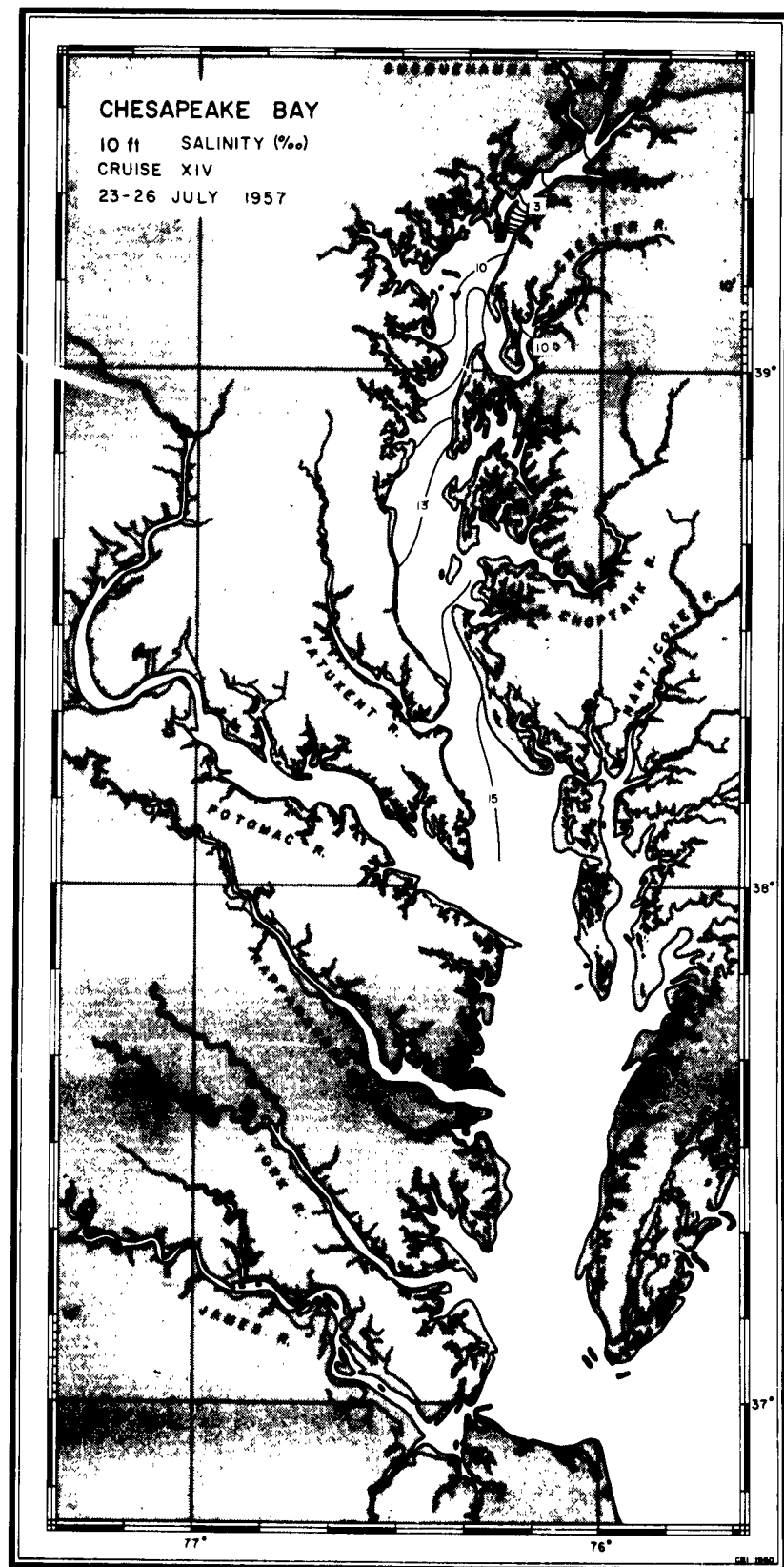
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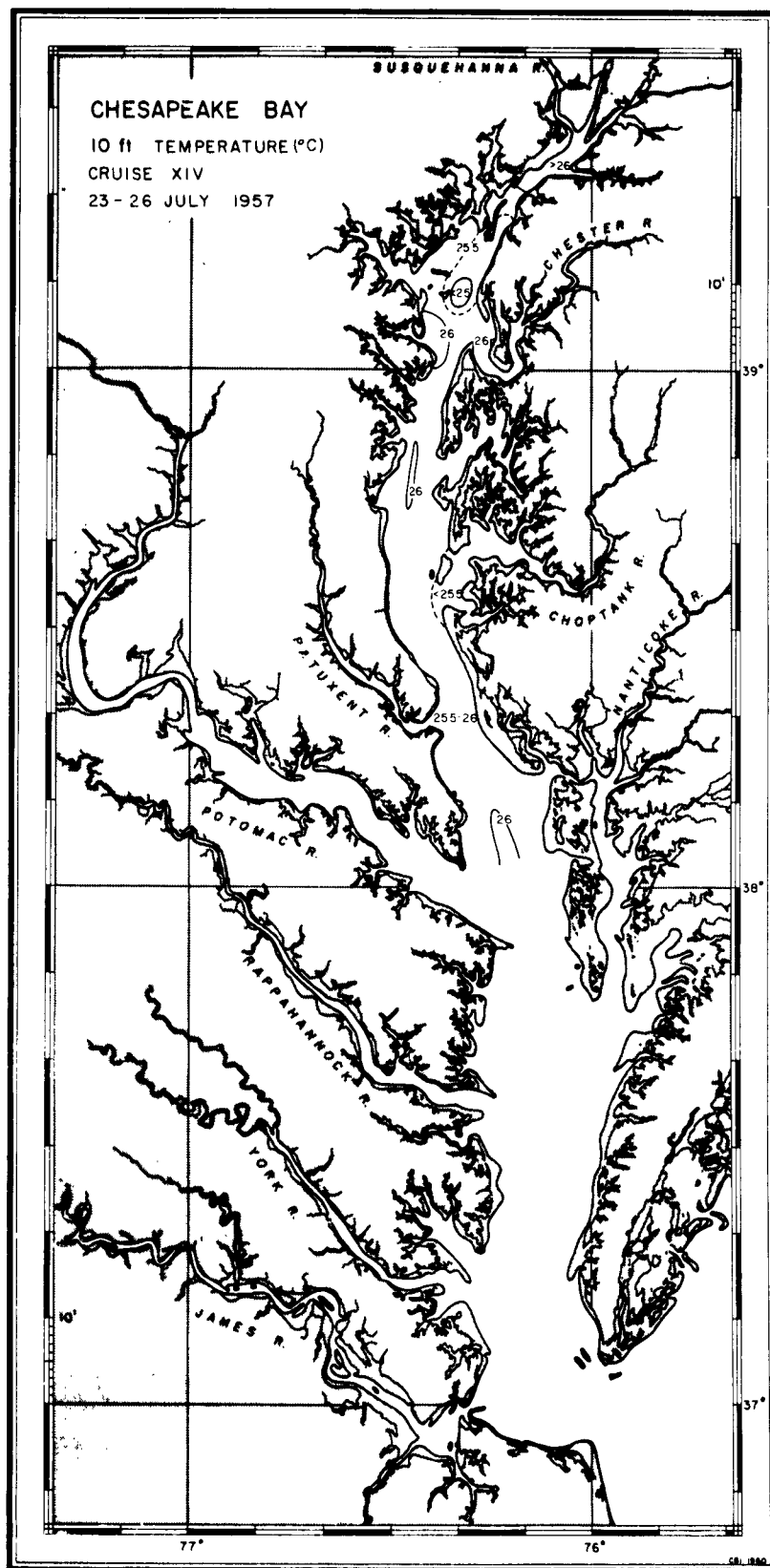
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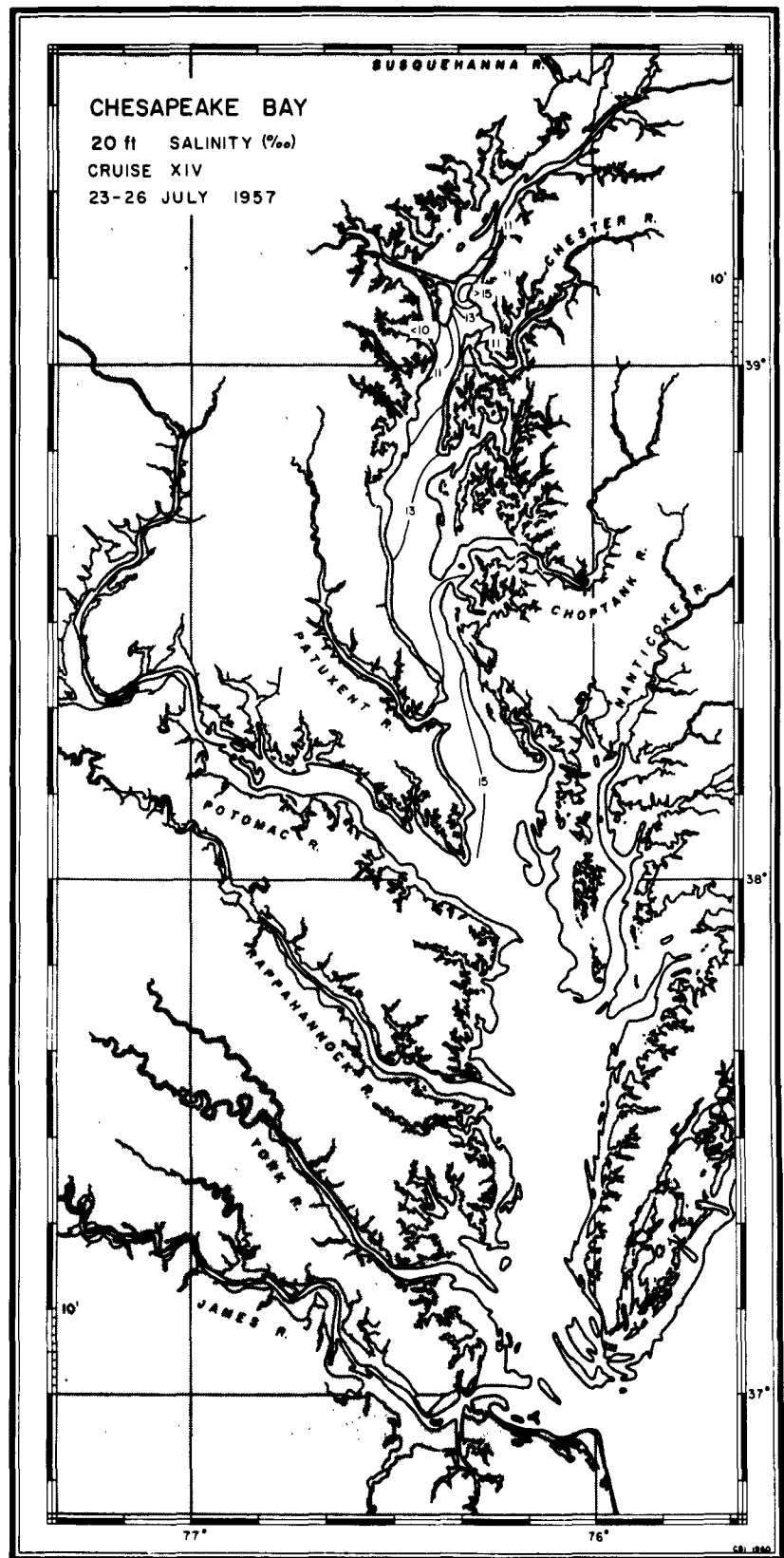


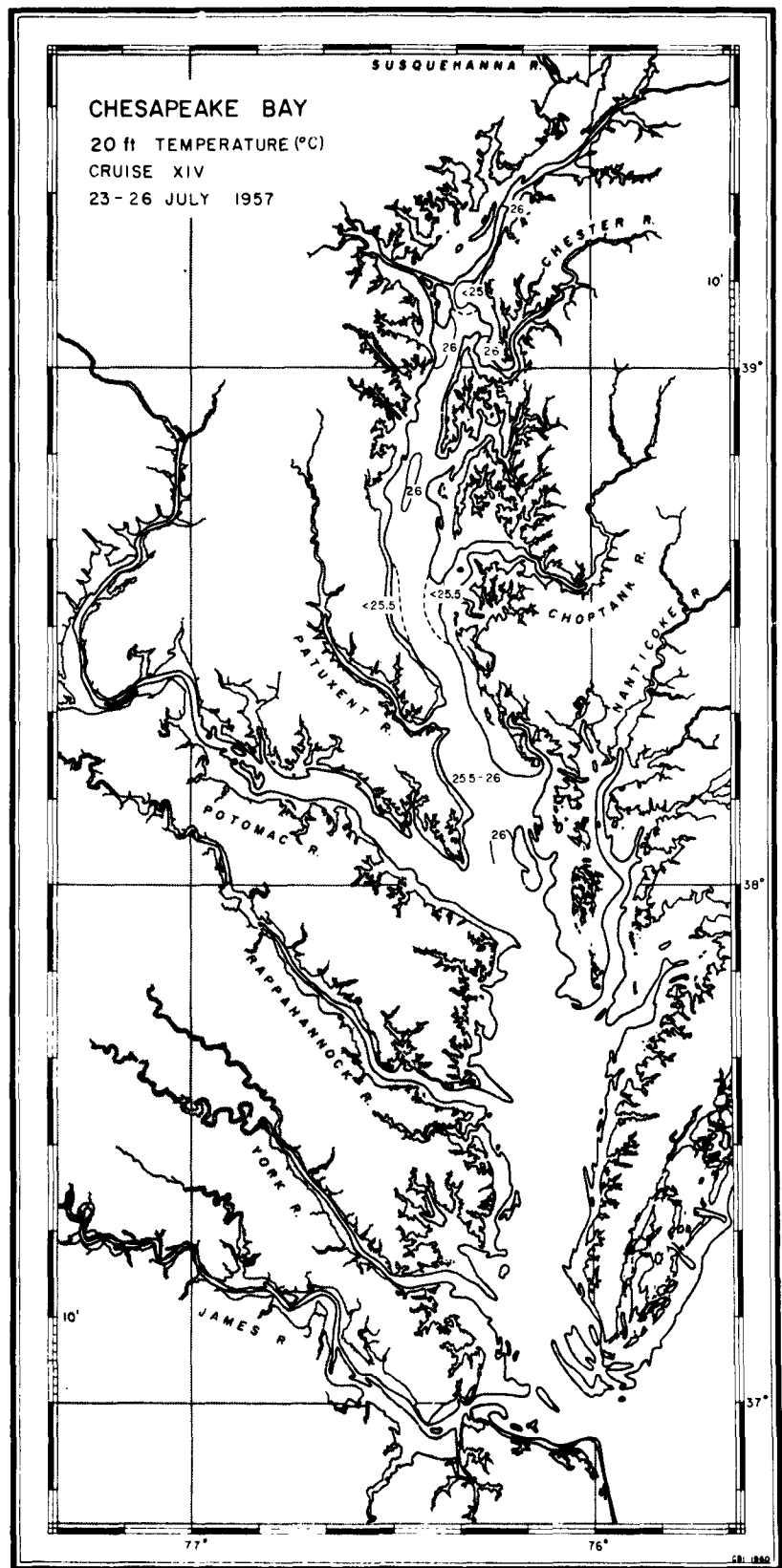


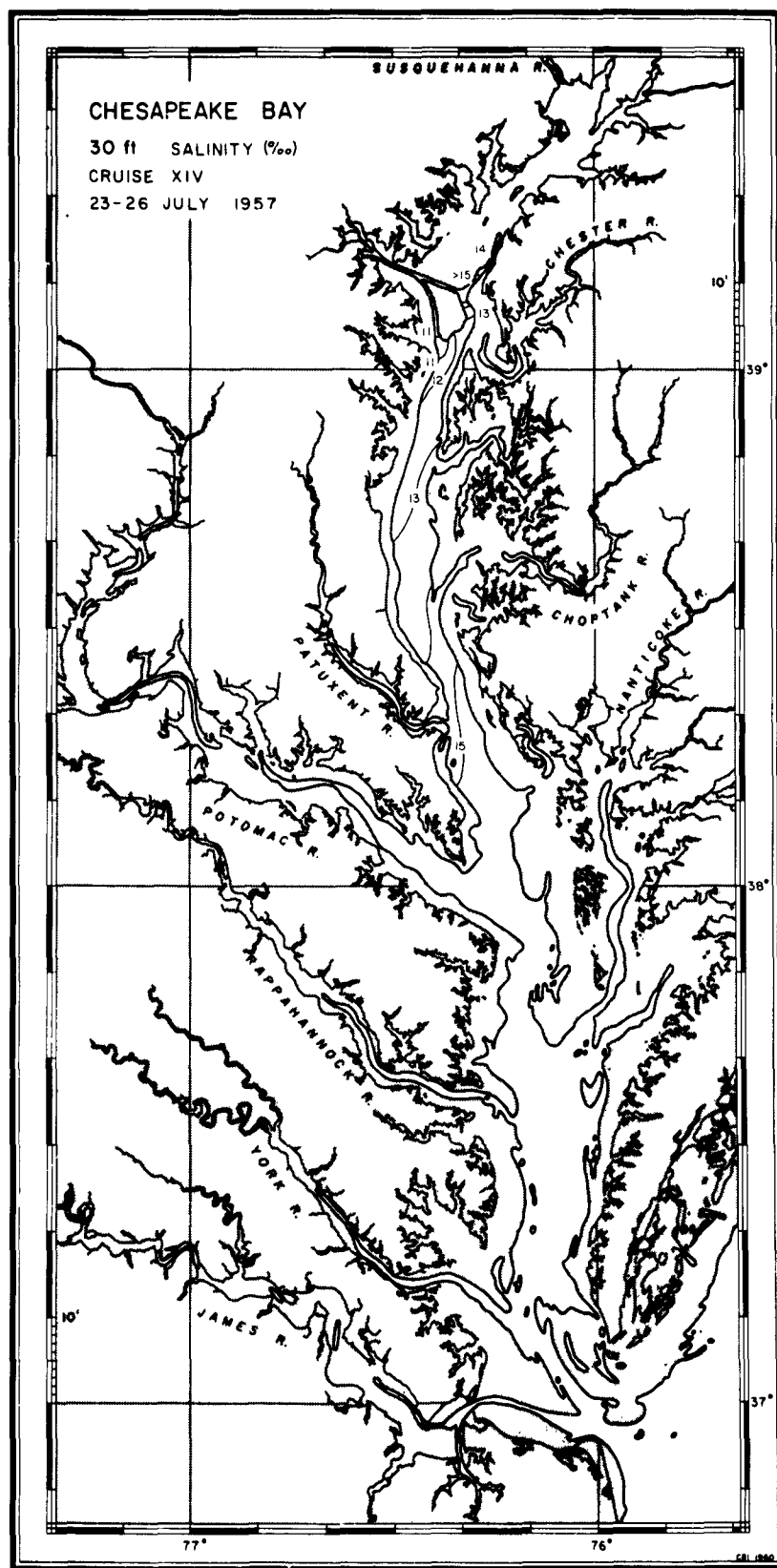


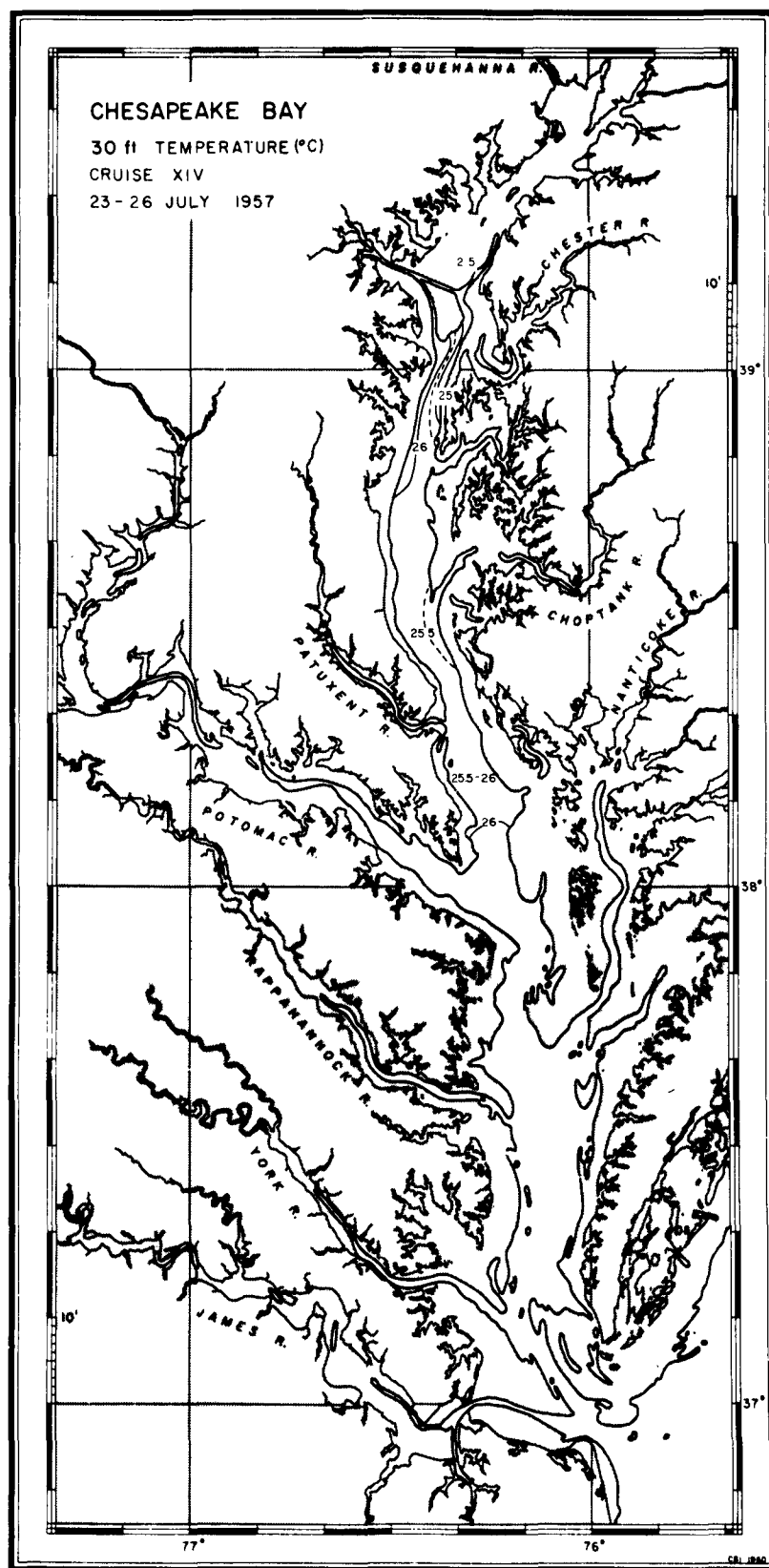


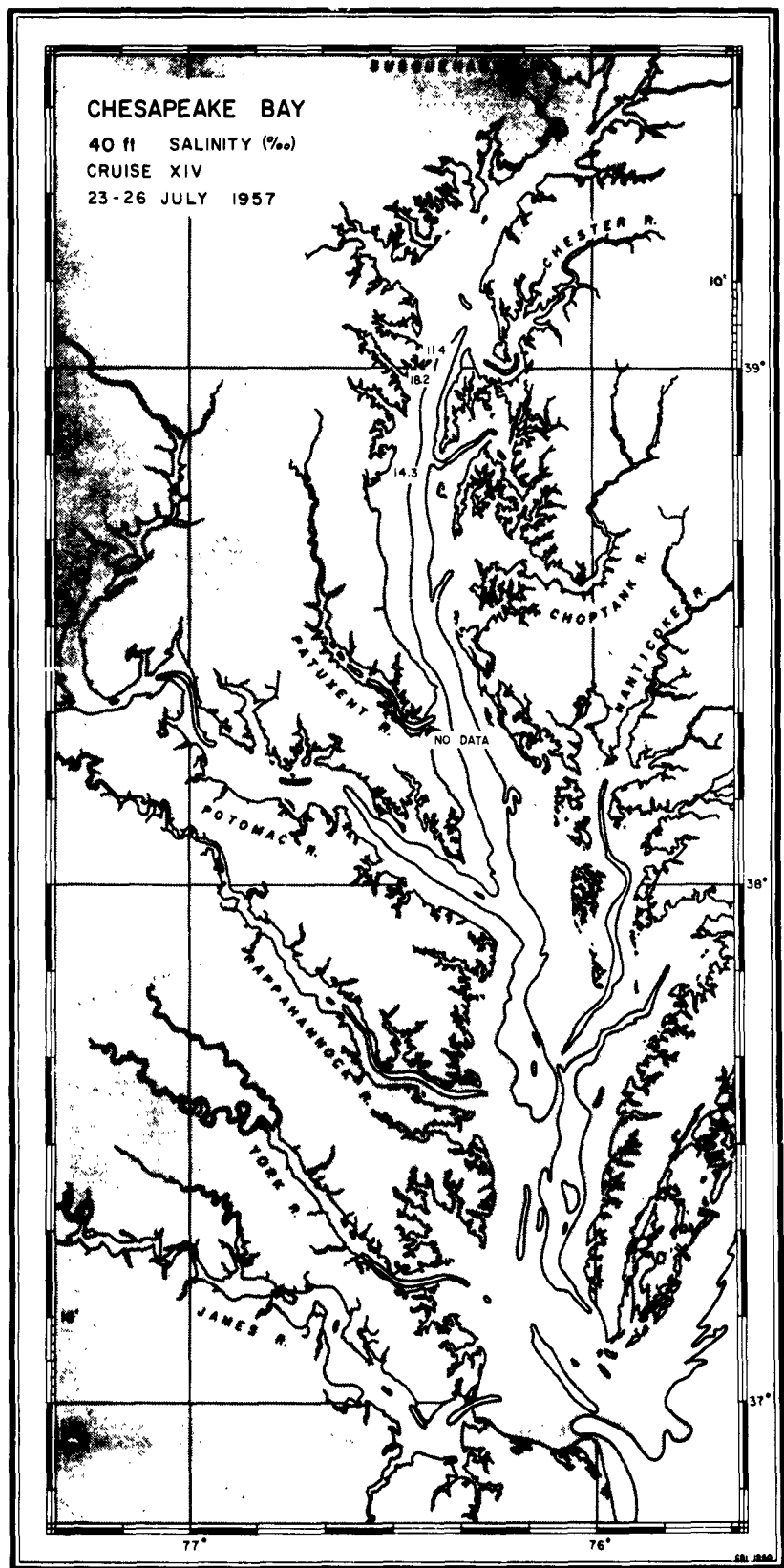


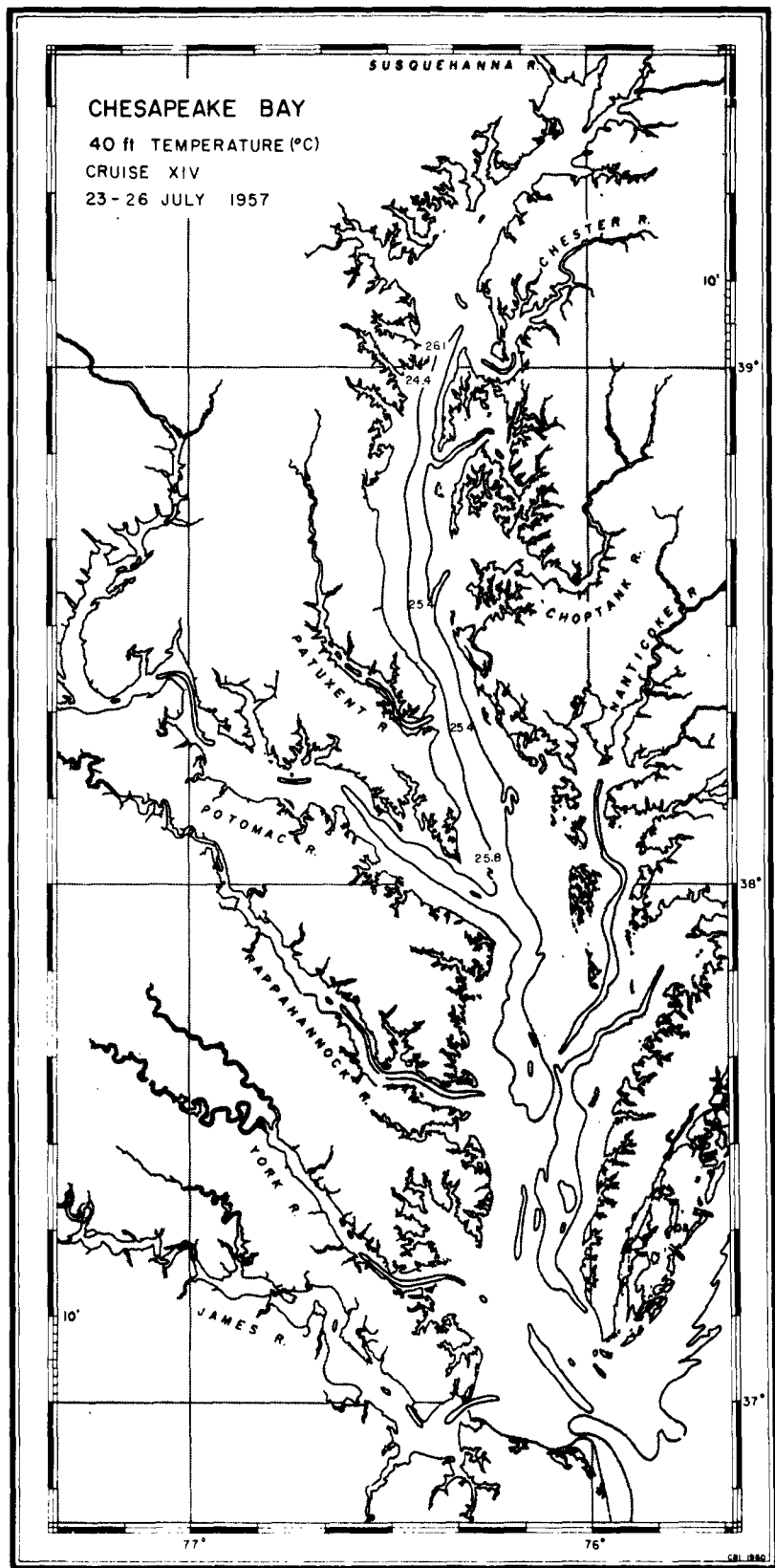




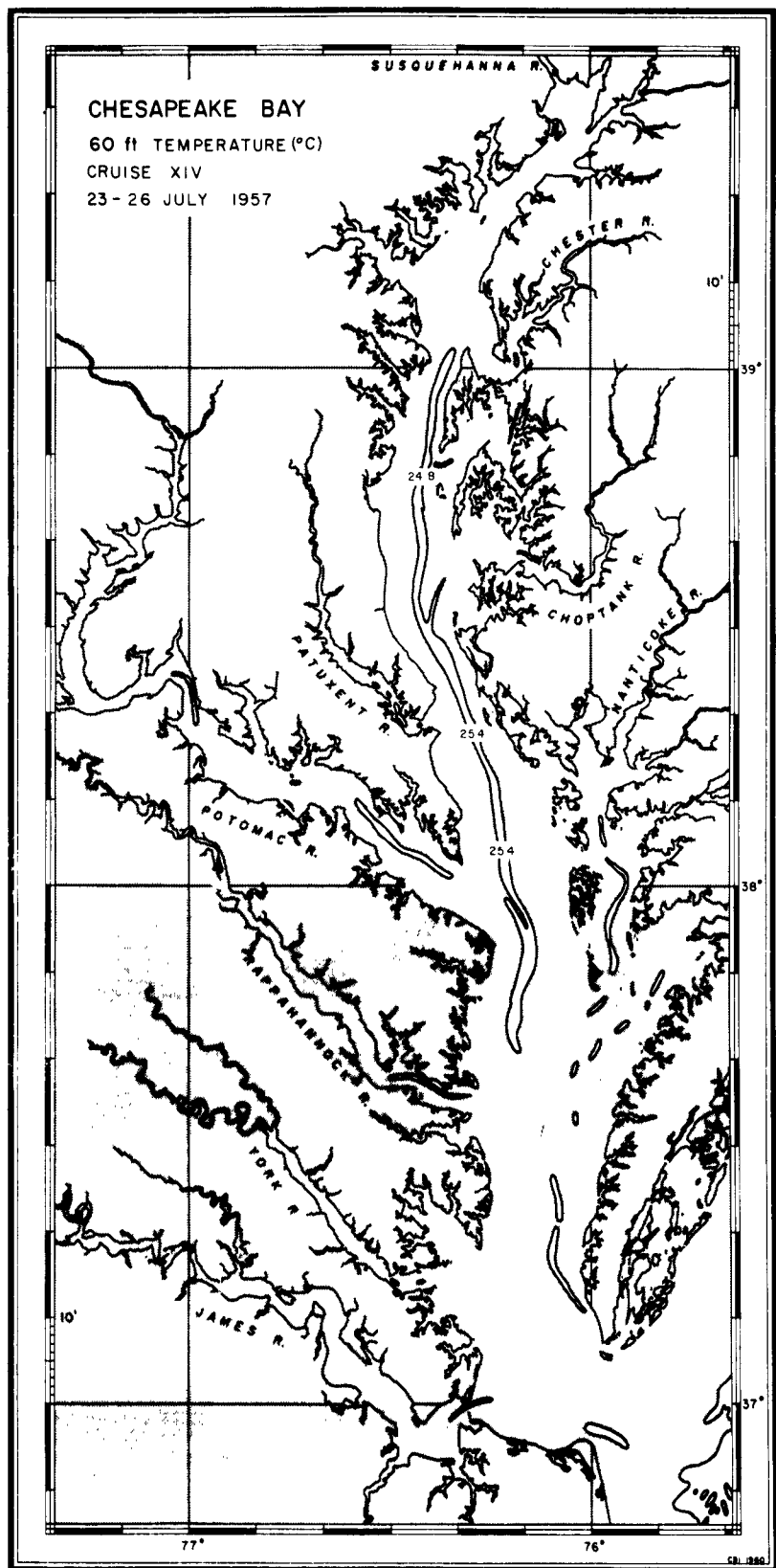






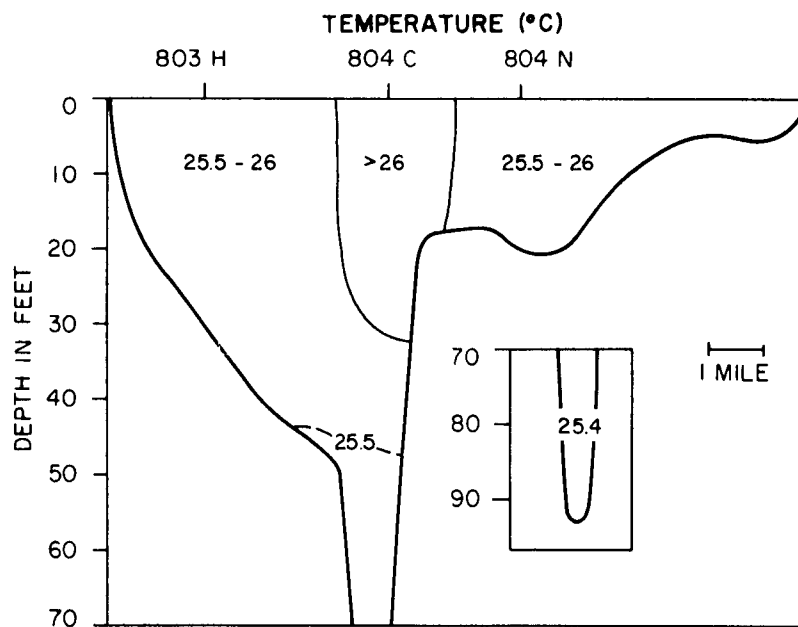
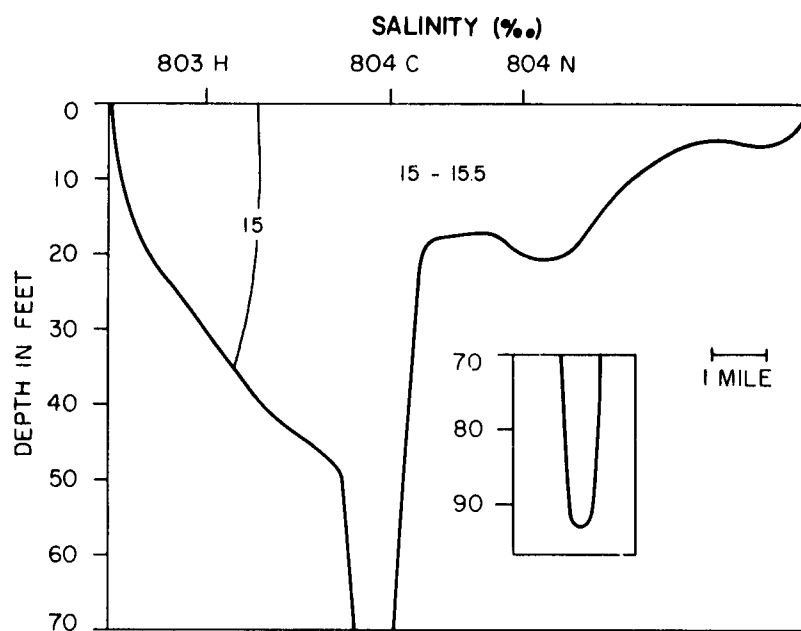


60 FT LEVEL OMITTED
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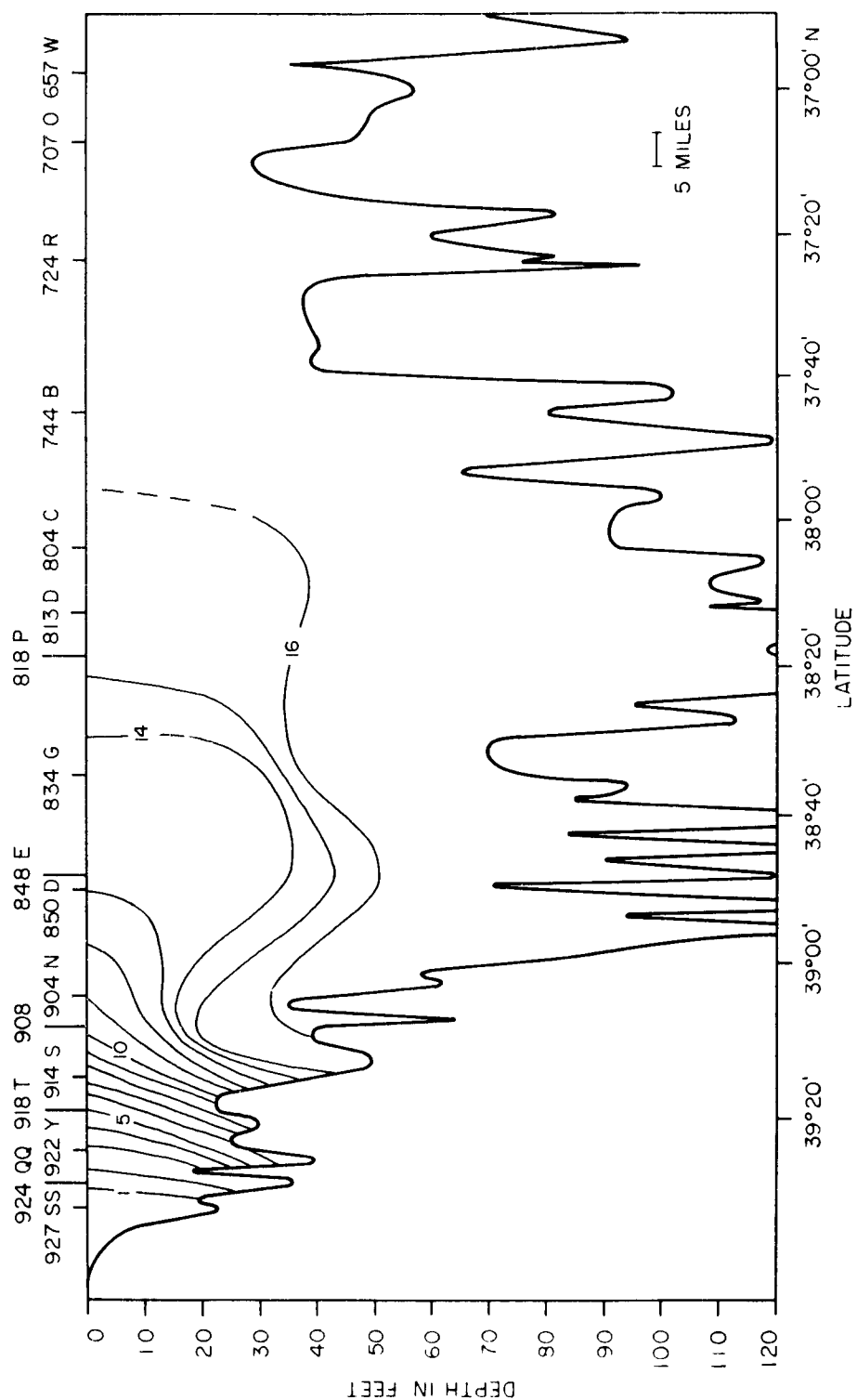


SECTIONS OMITTED
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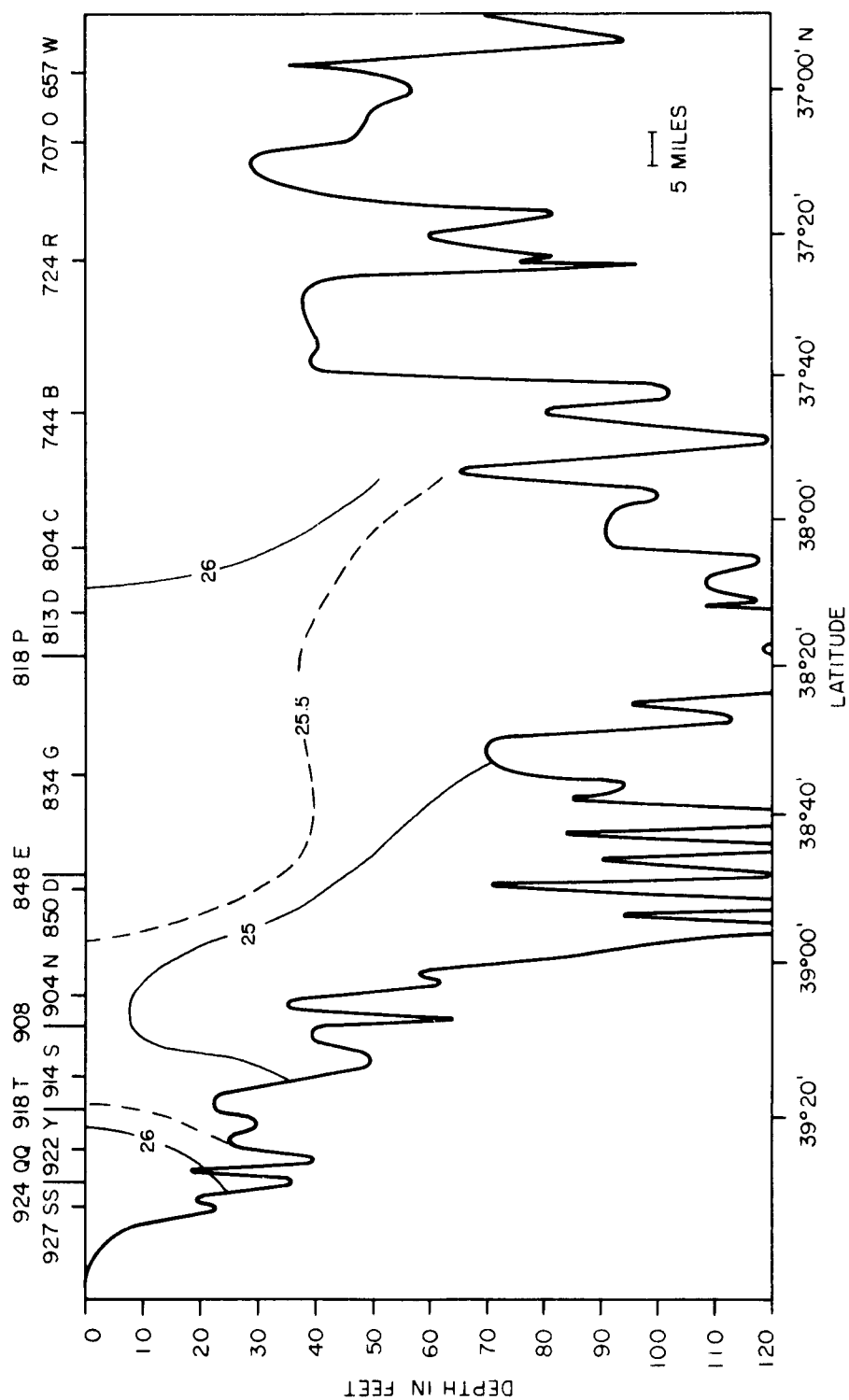
CRUISE XIV 23 - 26 JULY 1957 SECTION VI

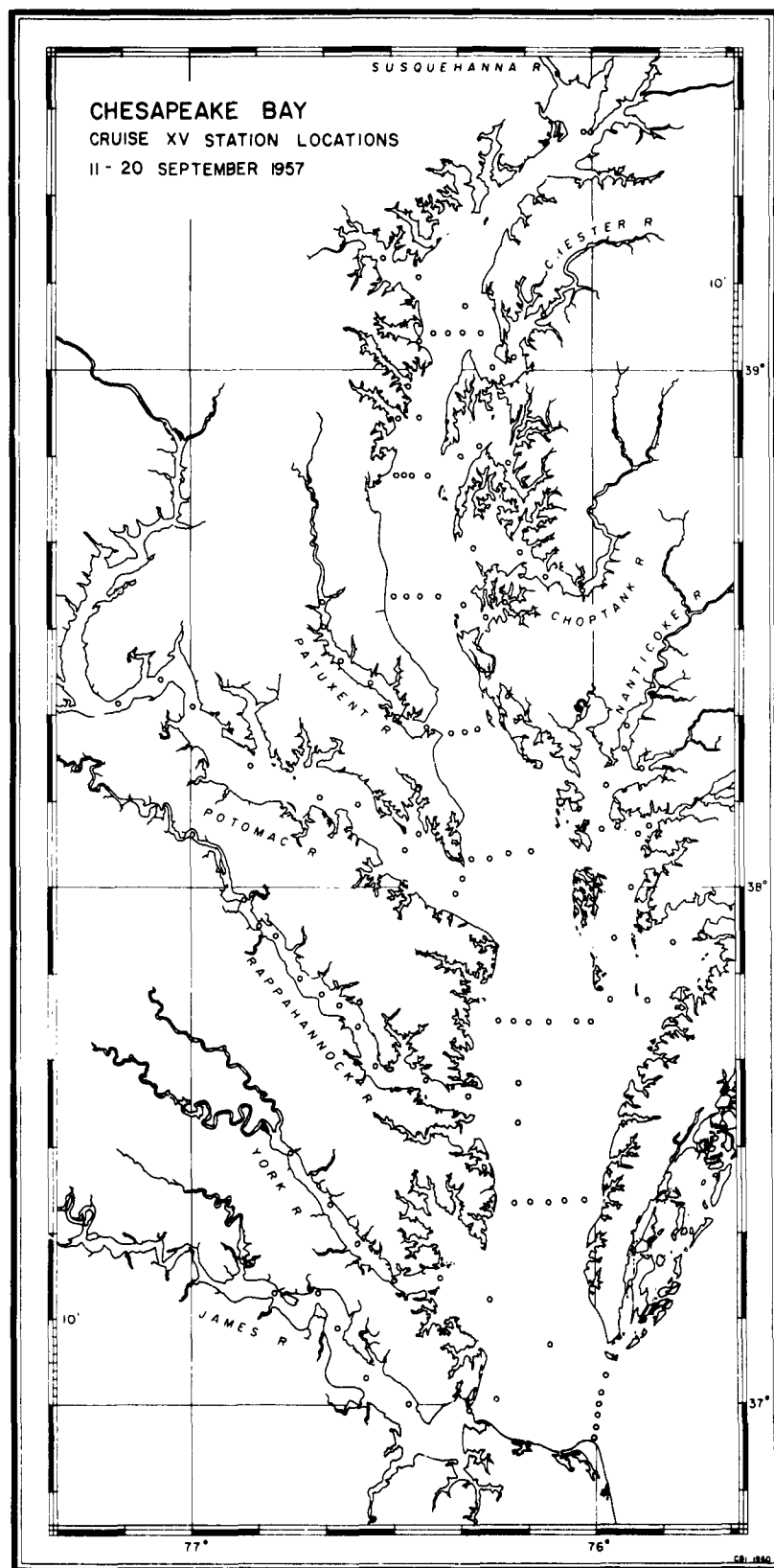


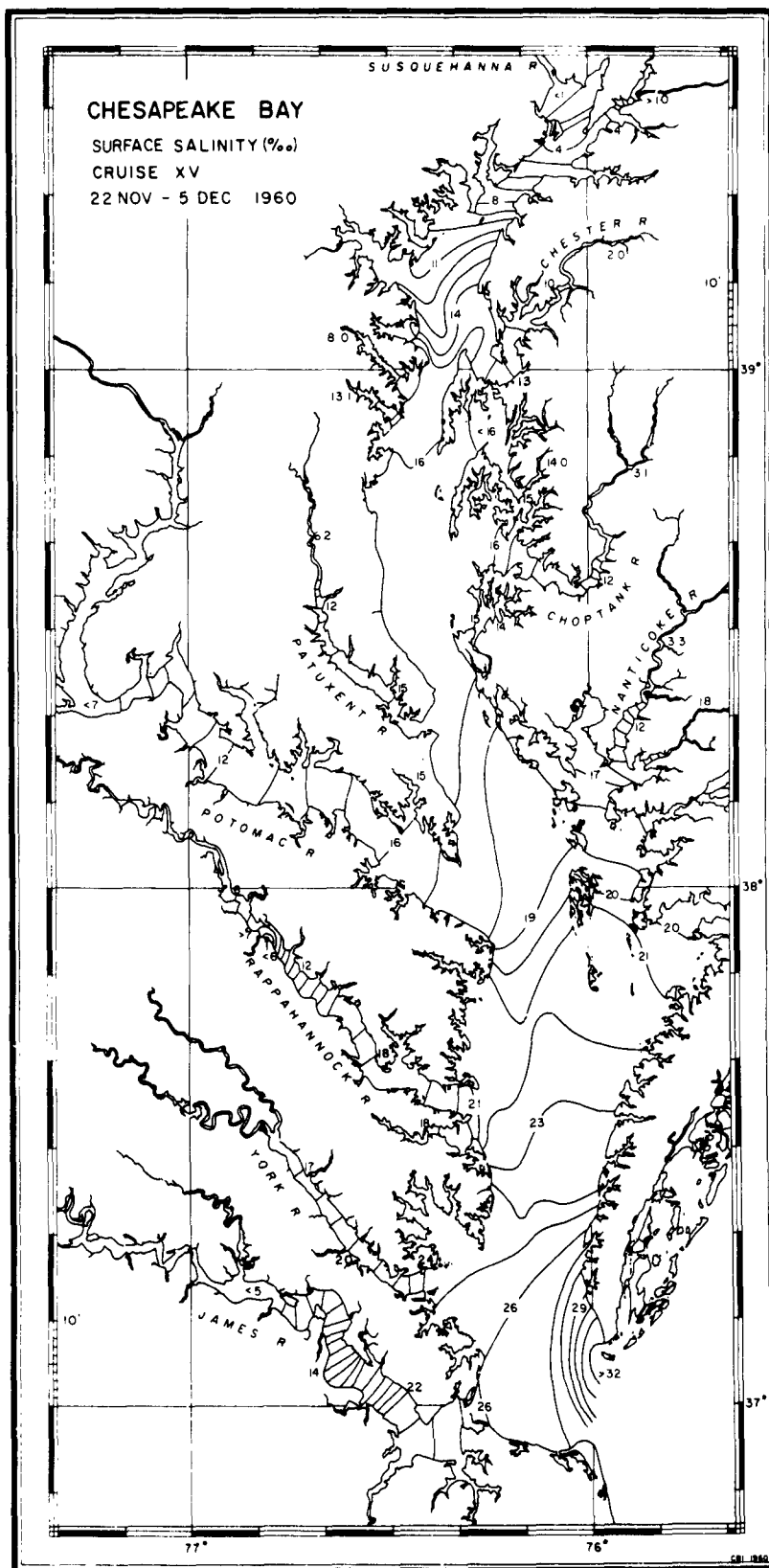
CRUISE XIV 23 - 26 JULY 1957 SECTION XIX
SALINITY (‰)

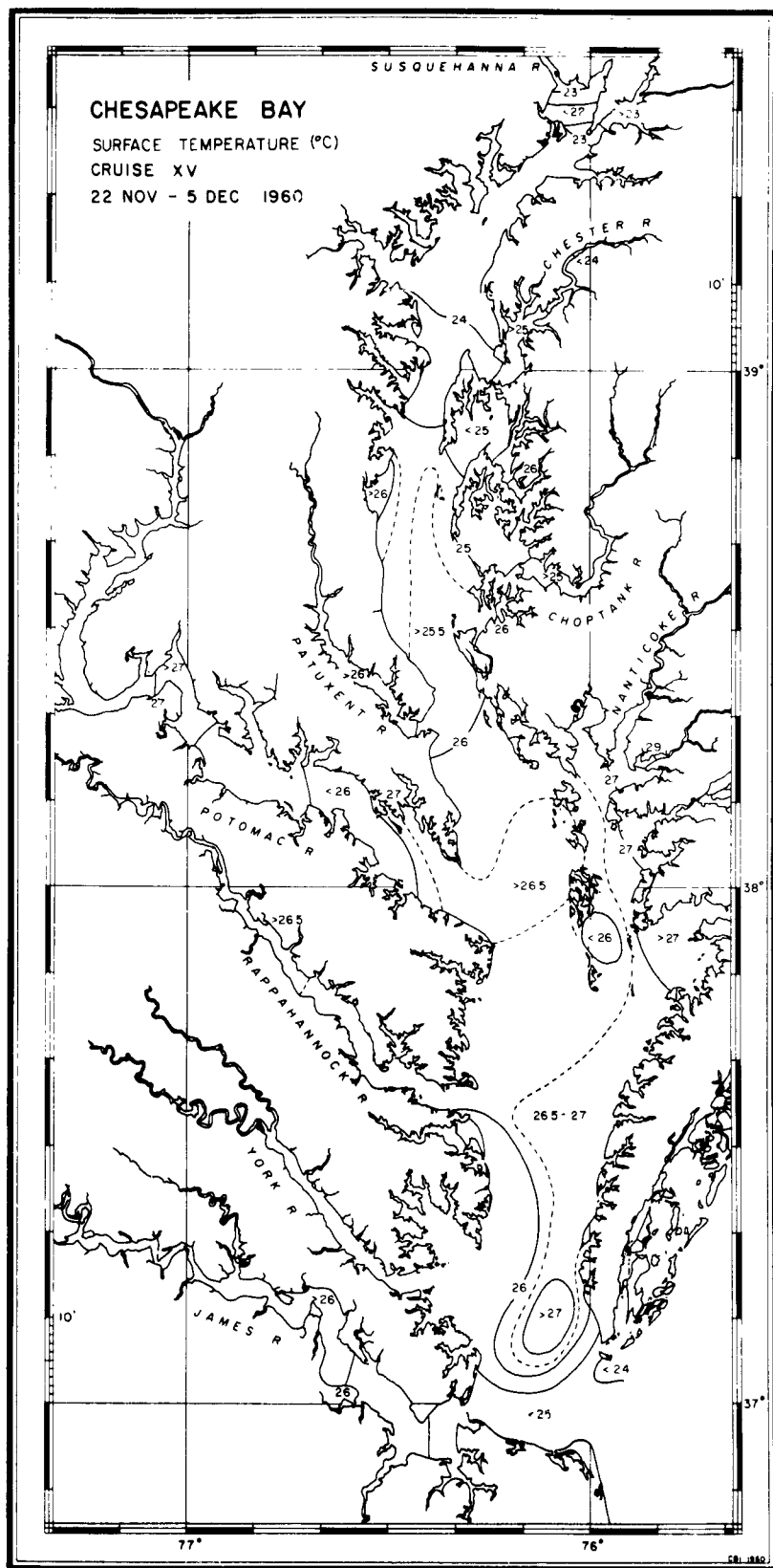


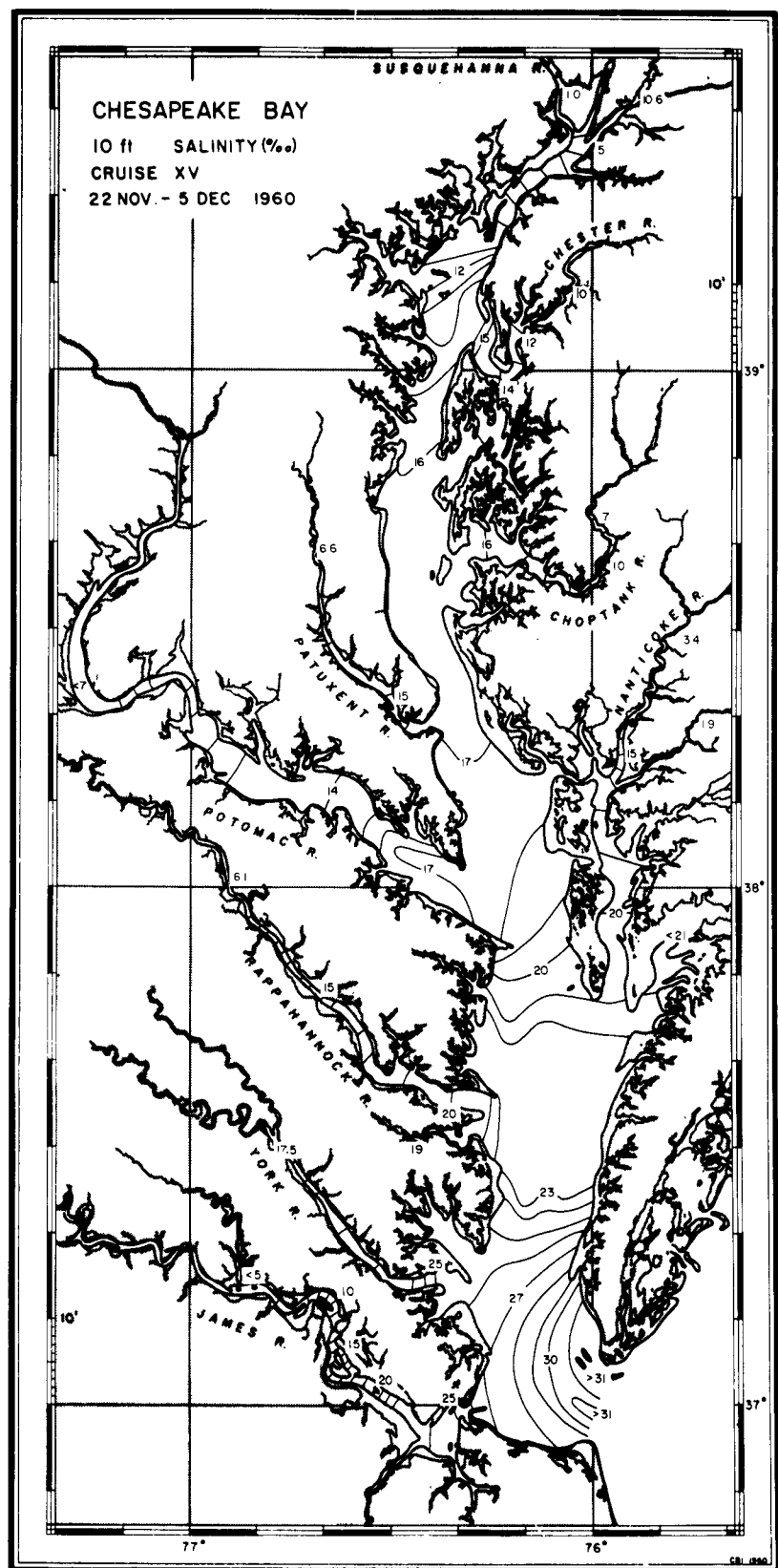
CRUISE XIV 23 - 26 JULY 1957 SECTION XIX
TEMPERATURE (°C)

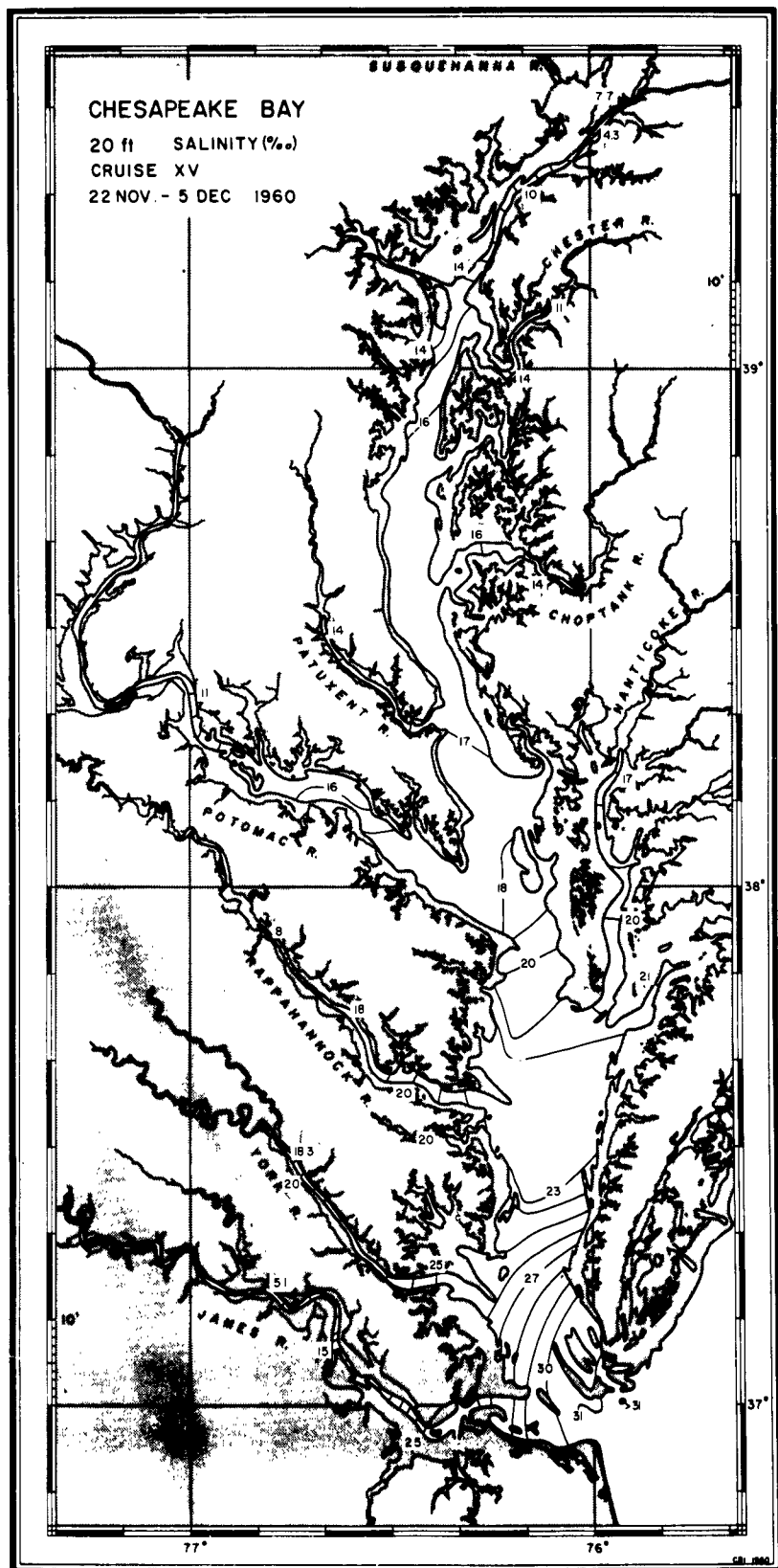


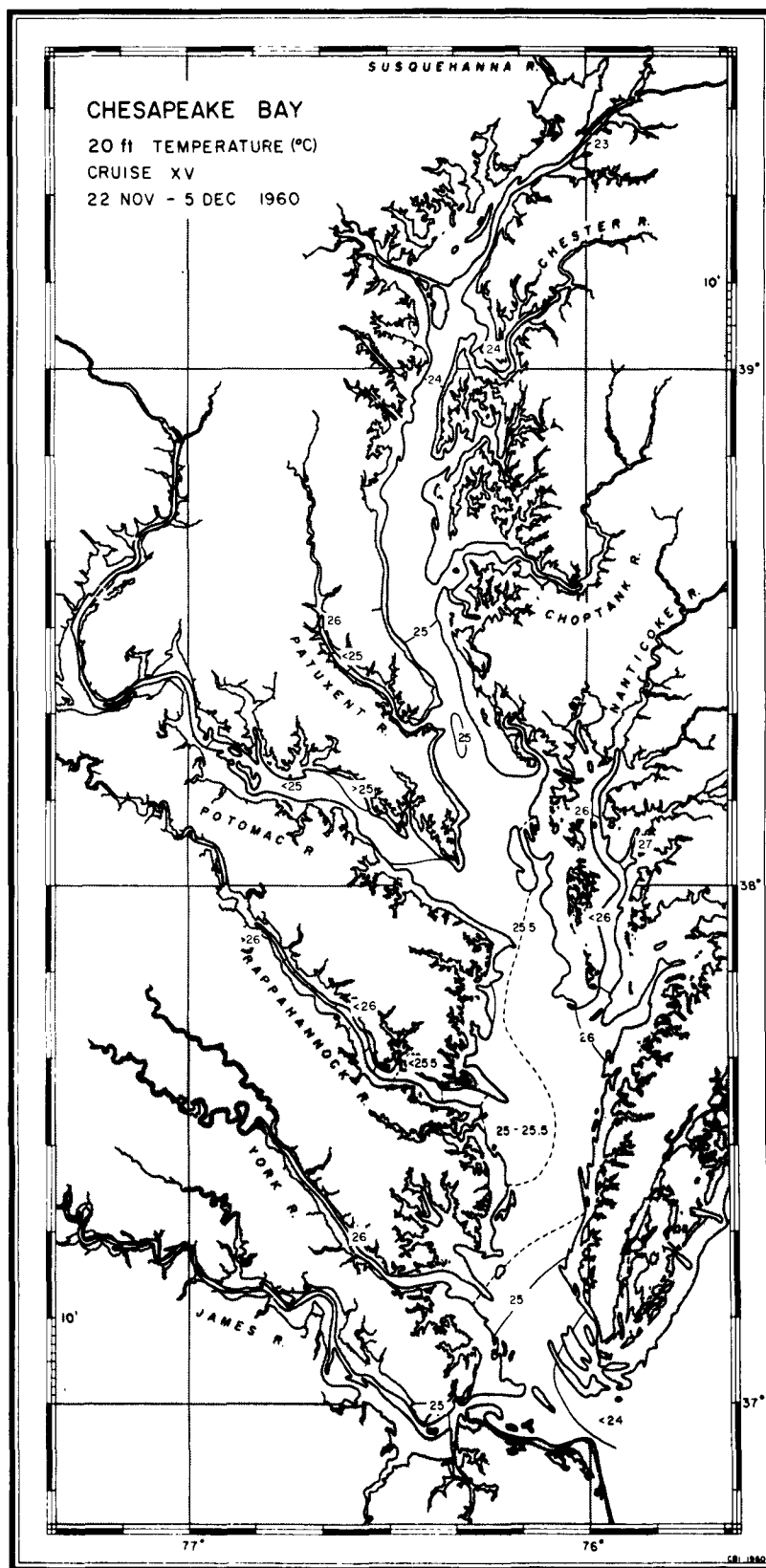


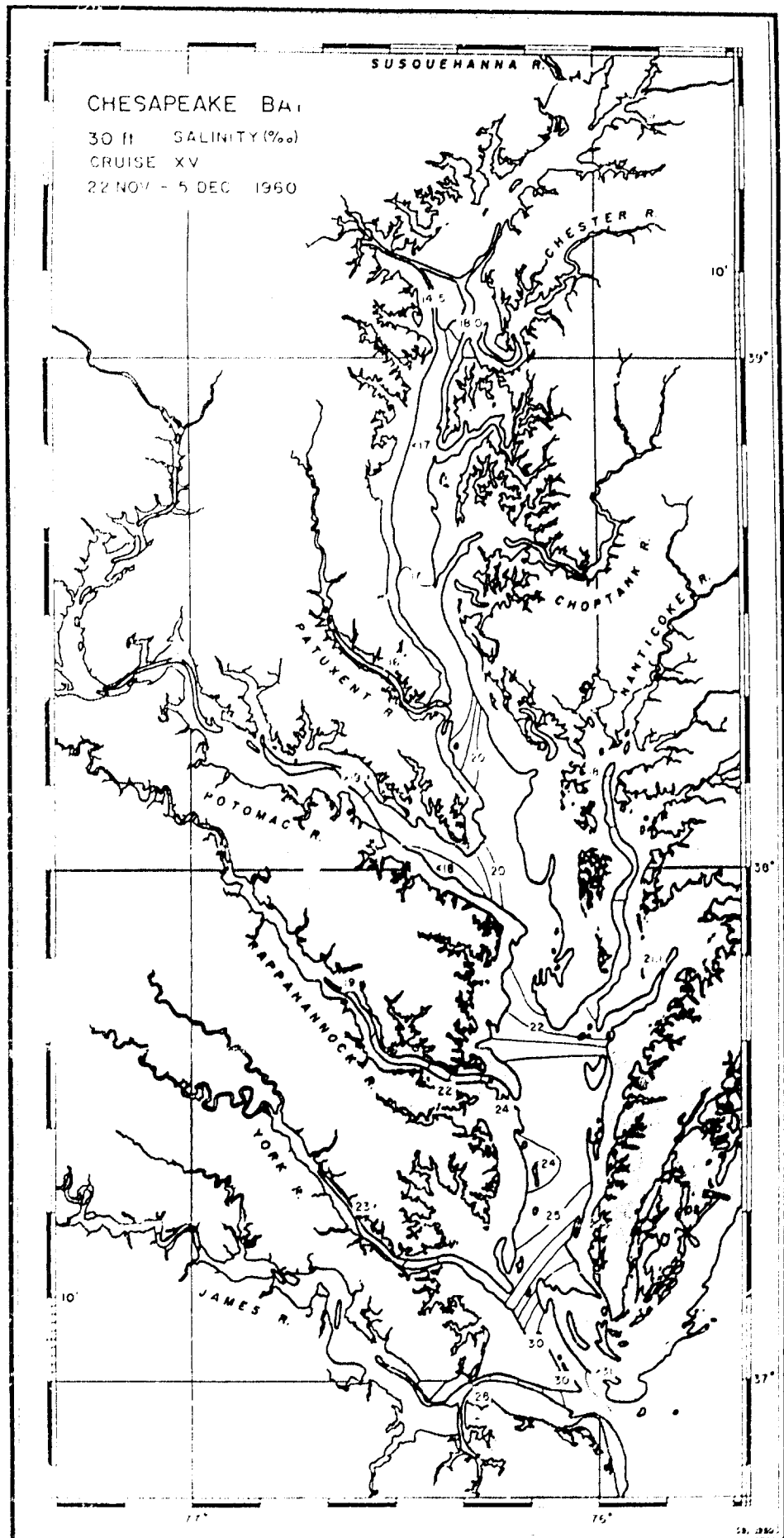


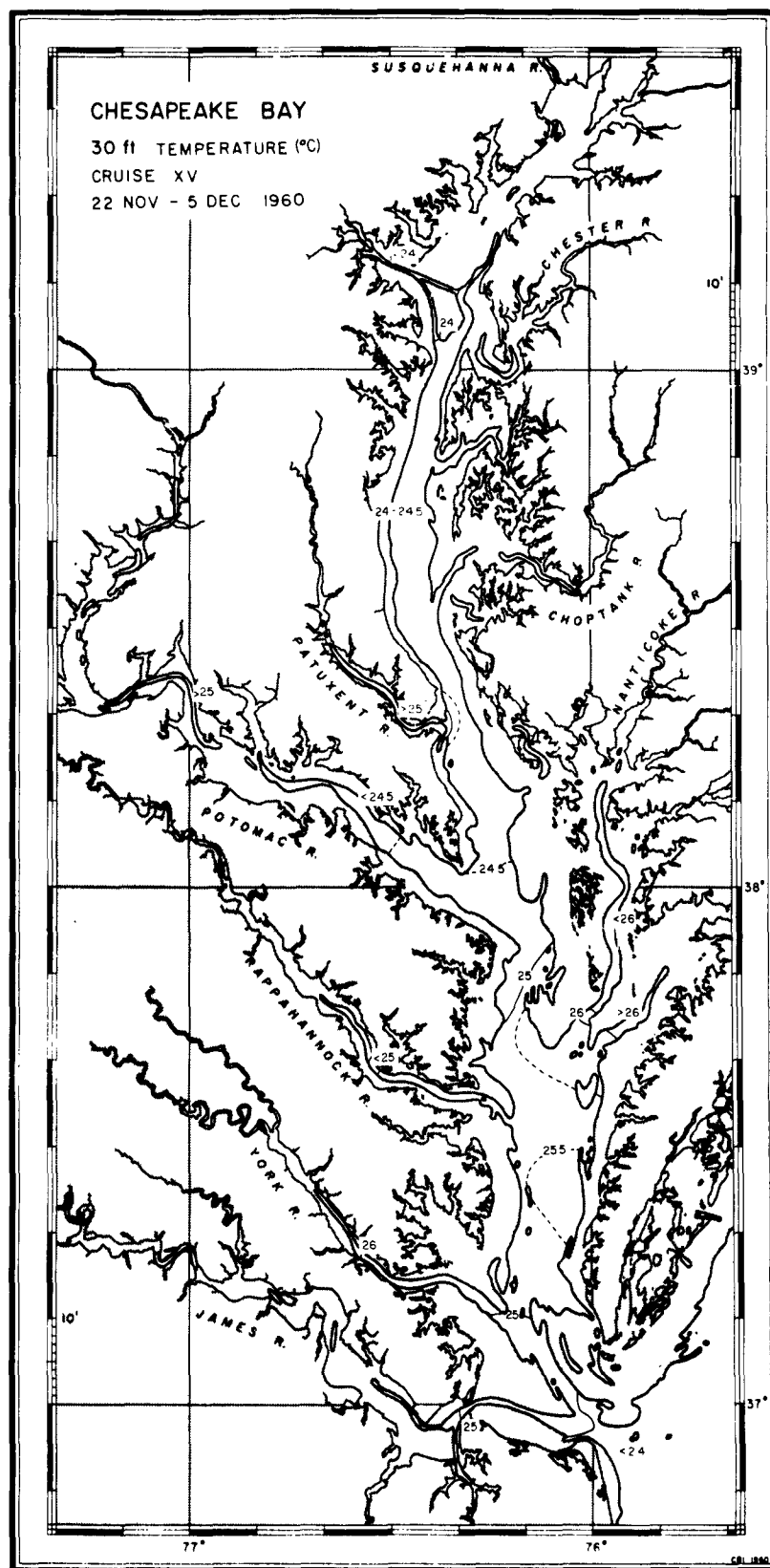


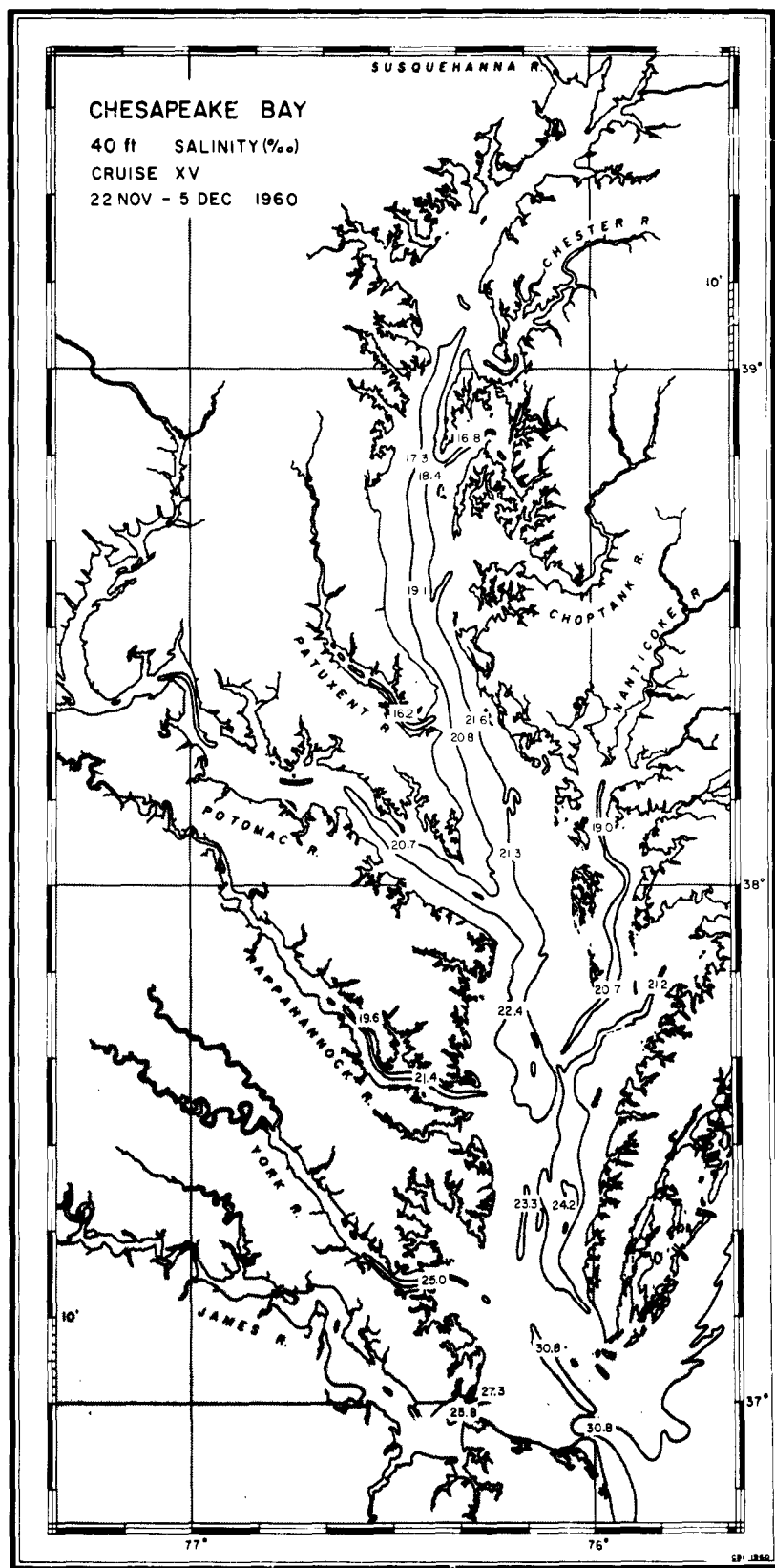


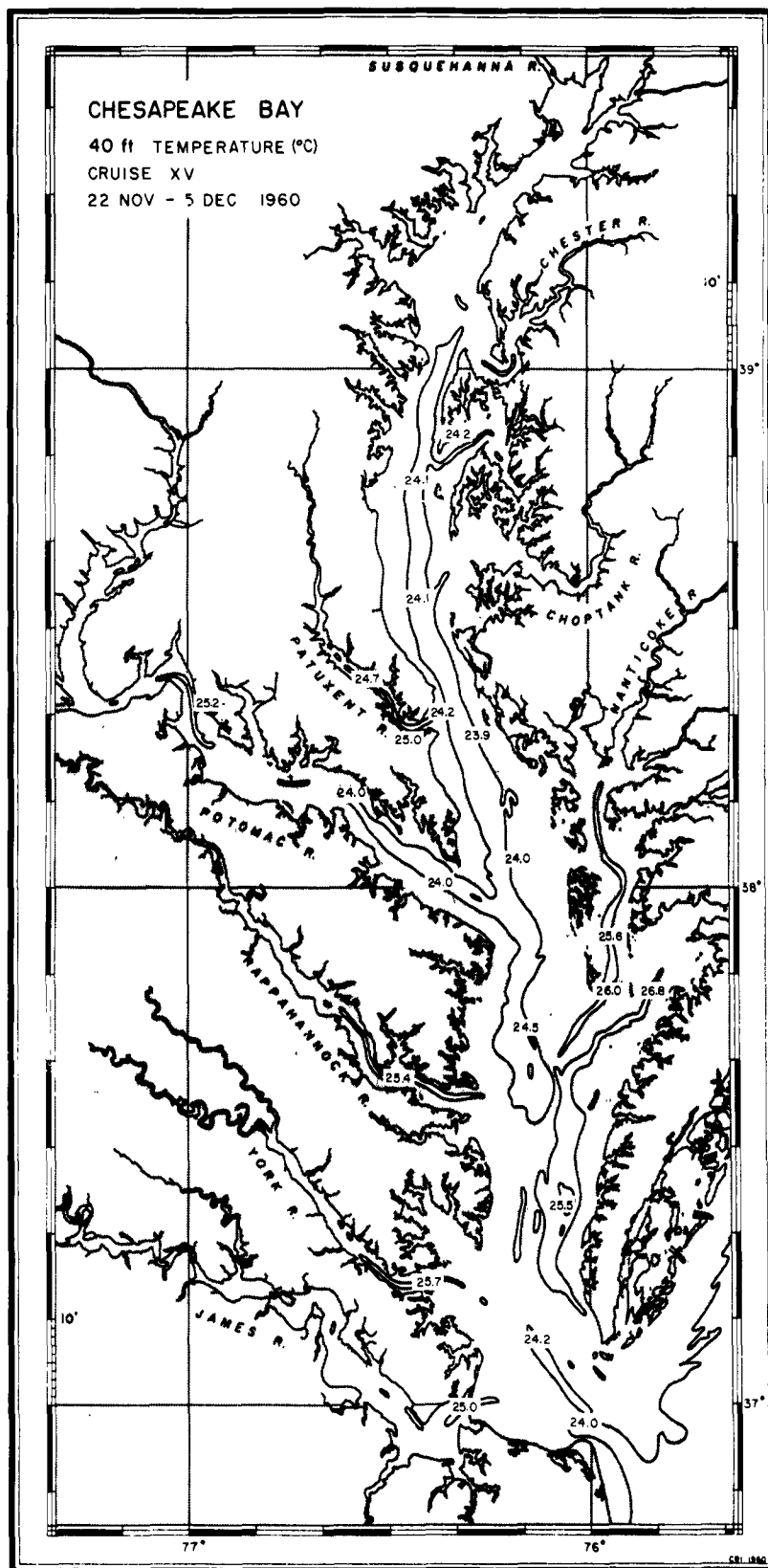


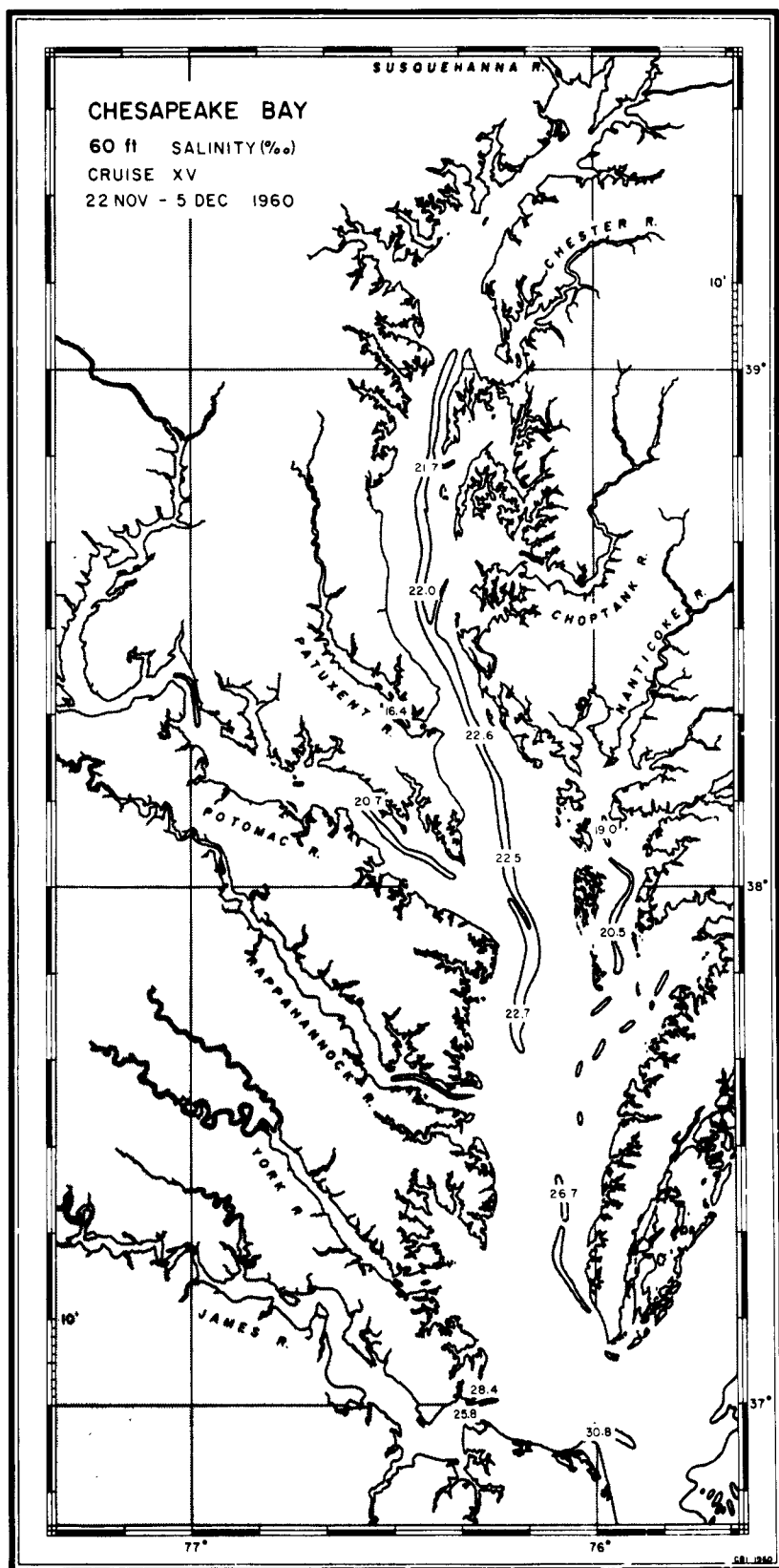


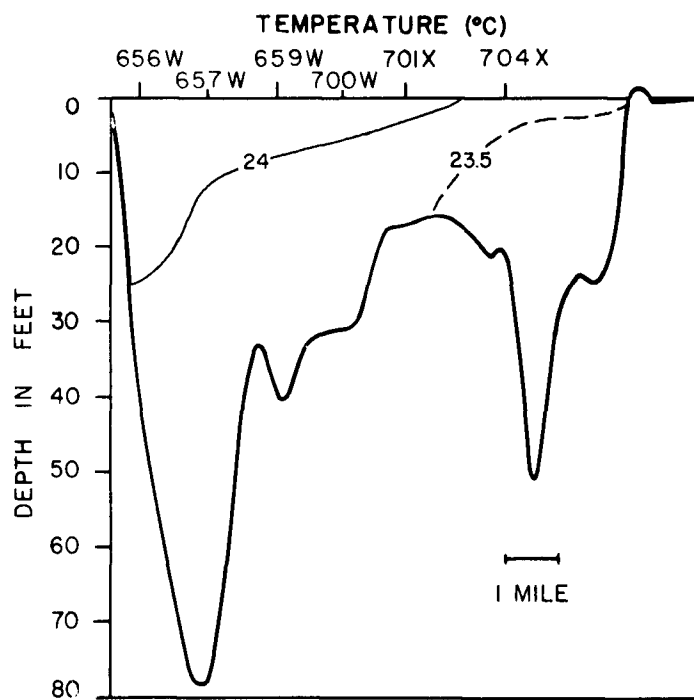
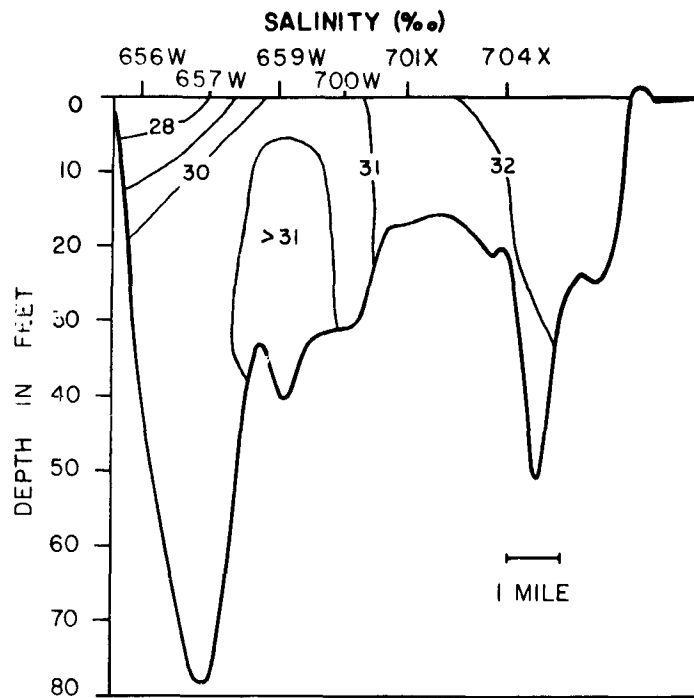




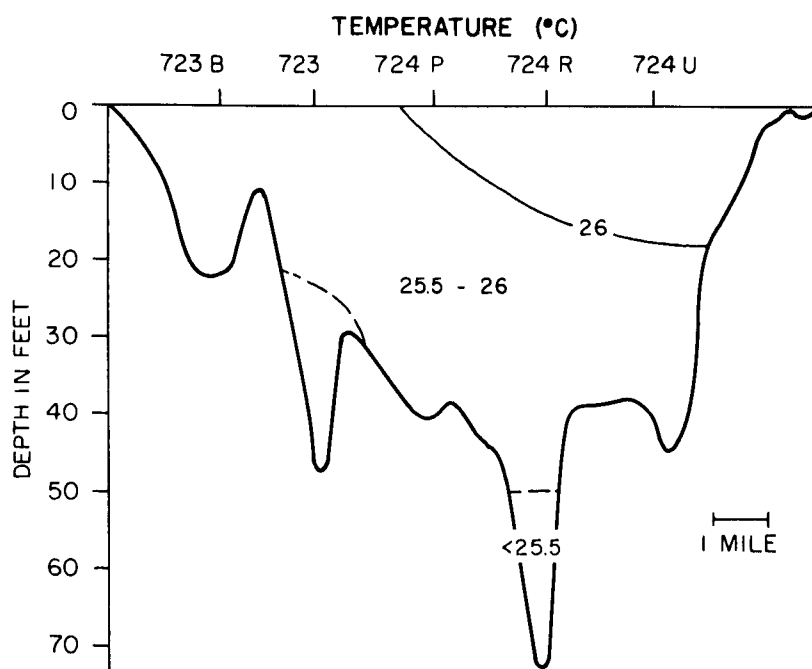
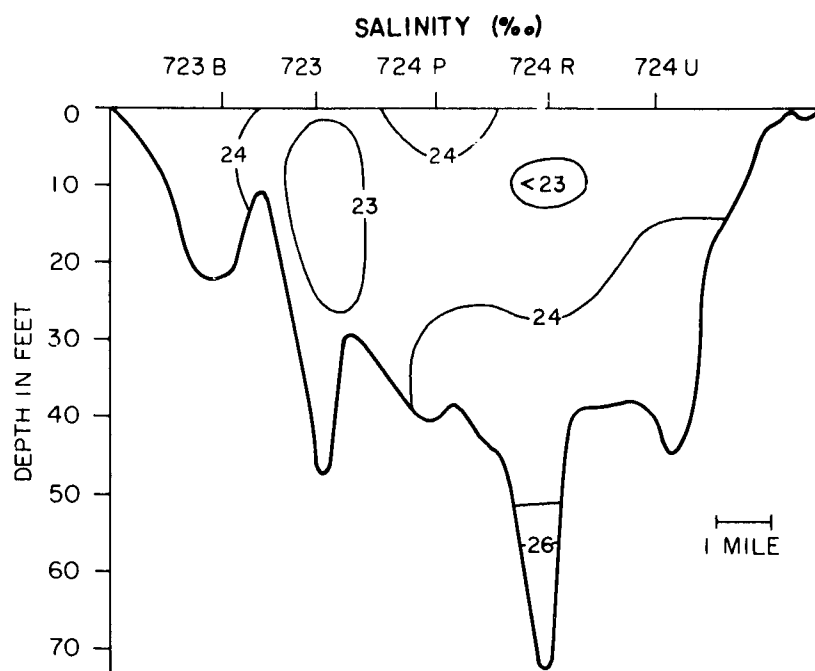




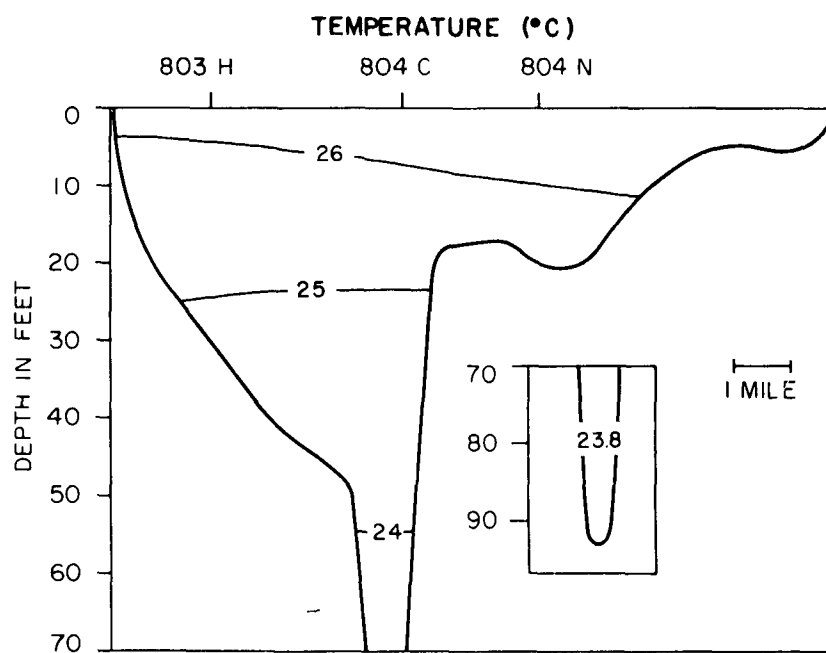
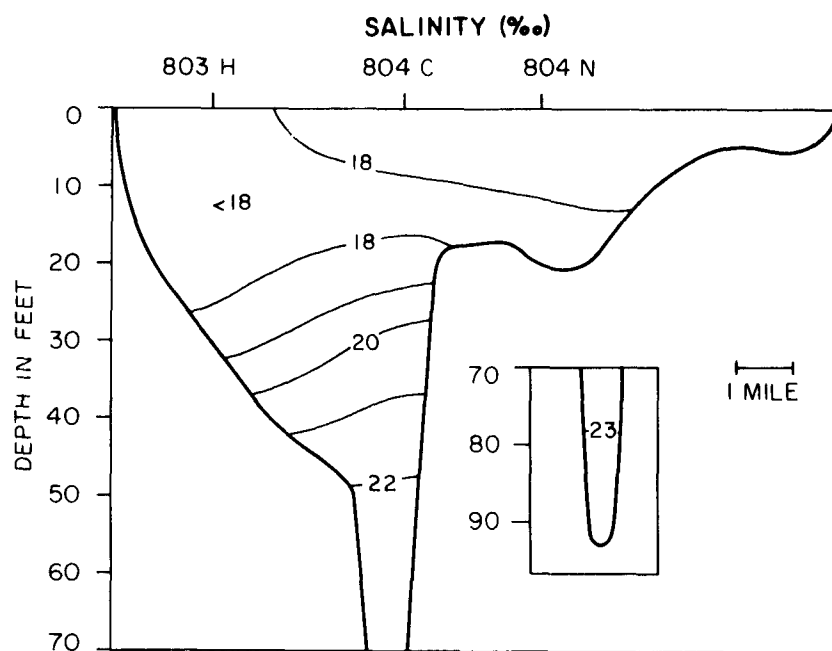




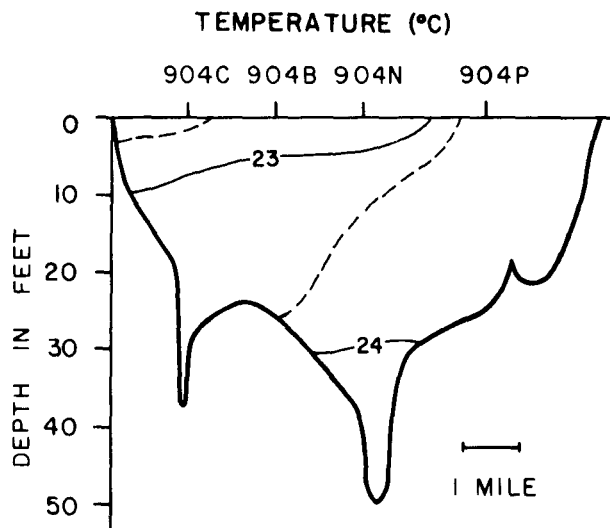
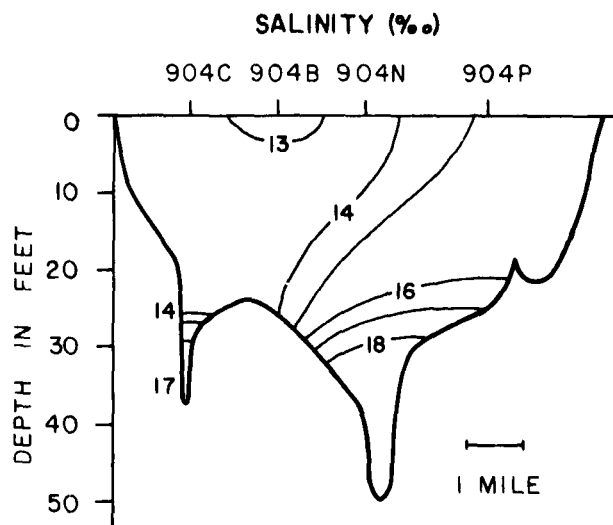
CRUISE XV 11 - 20 SEPTEMBER 1957 SECTION IV



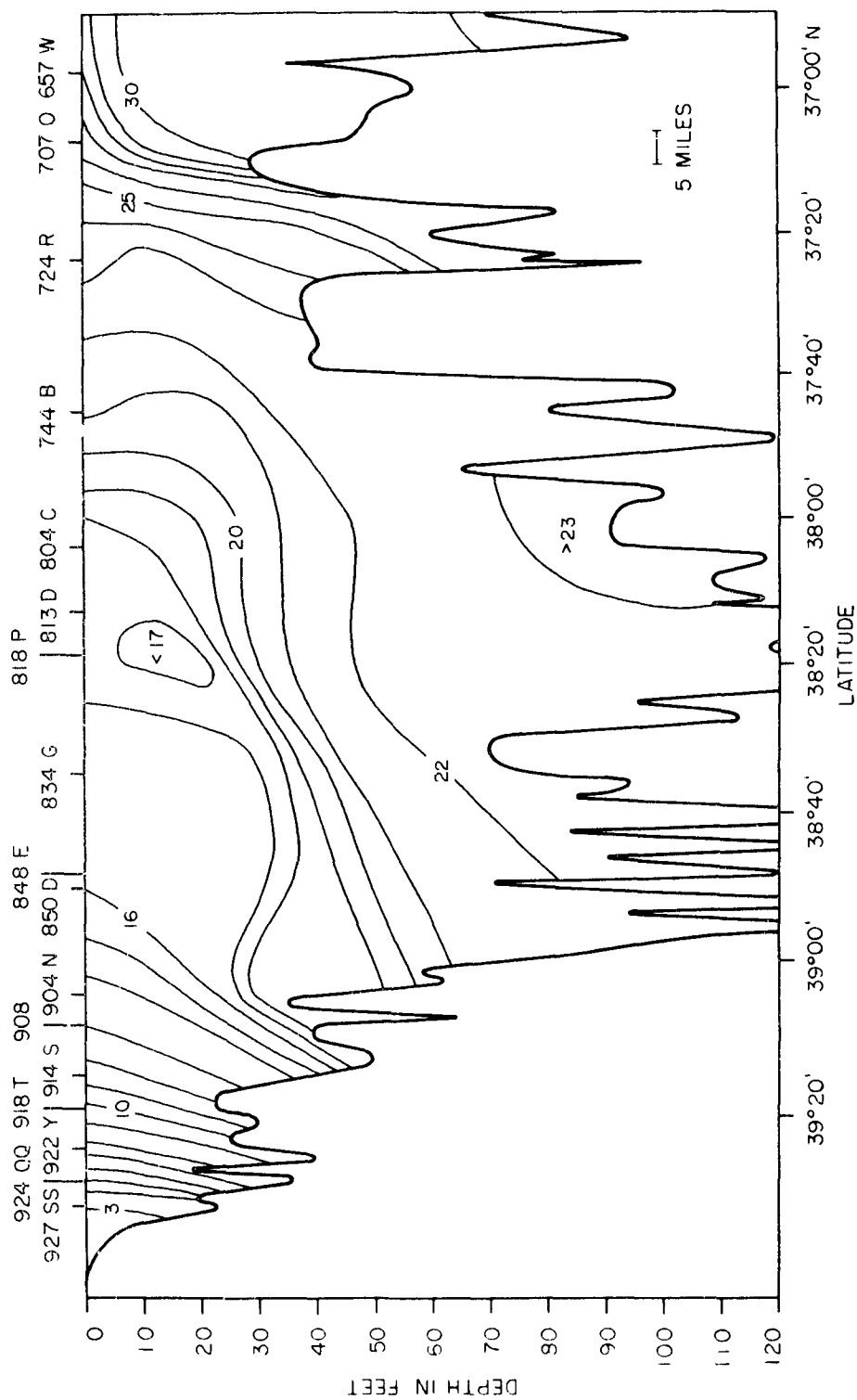
CRUISE XV 11 - 20 SEPTEMBER 1957 SECTION VI



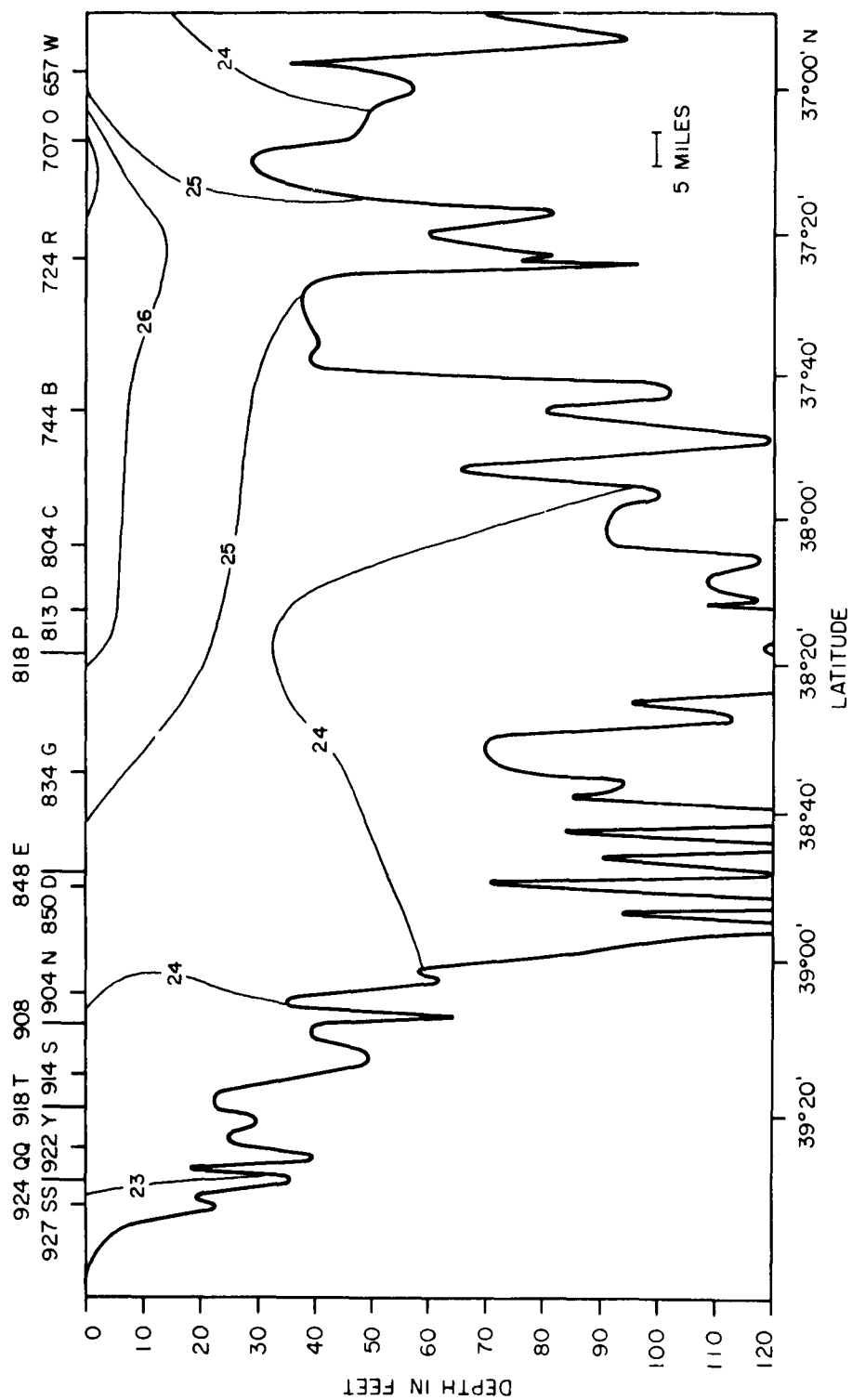
CRUISE XV 11 - 20 SEPTEMBER 1957 SECTION X

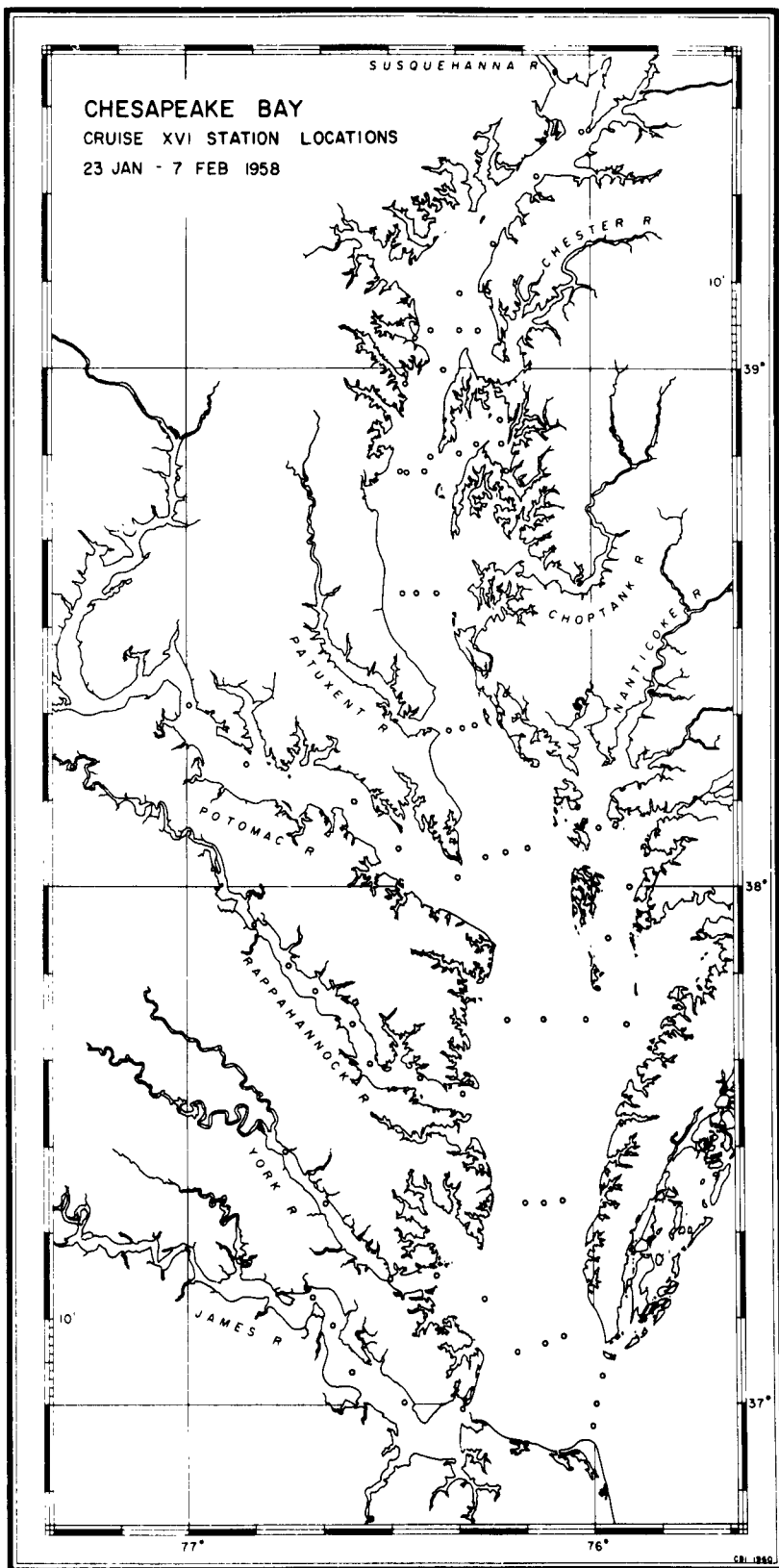


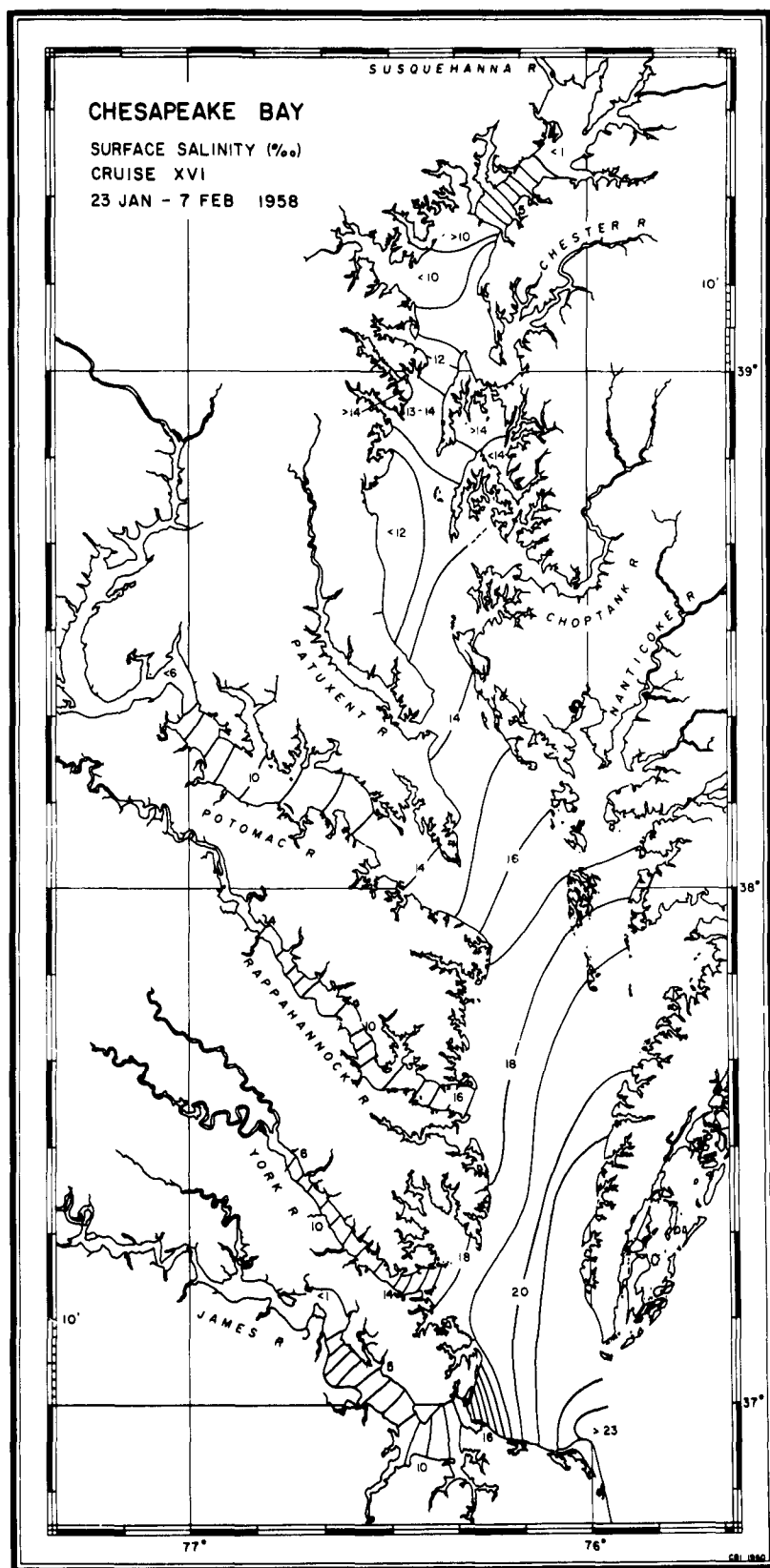
CRUISE XV 11 - 20 SEPTEMBER 1957 SECTION XIX
SALINITY (‰)

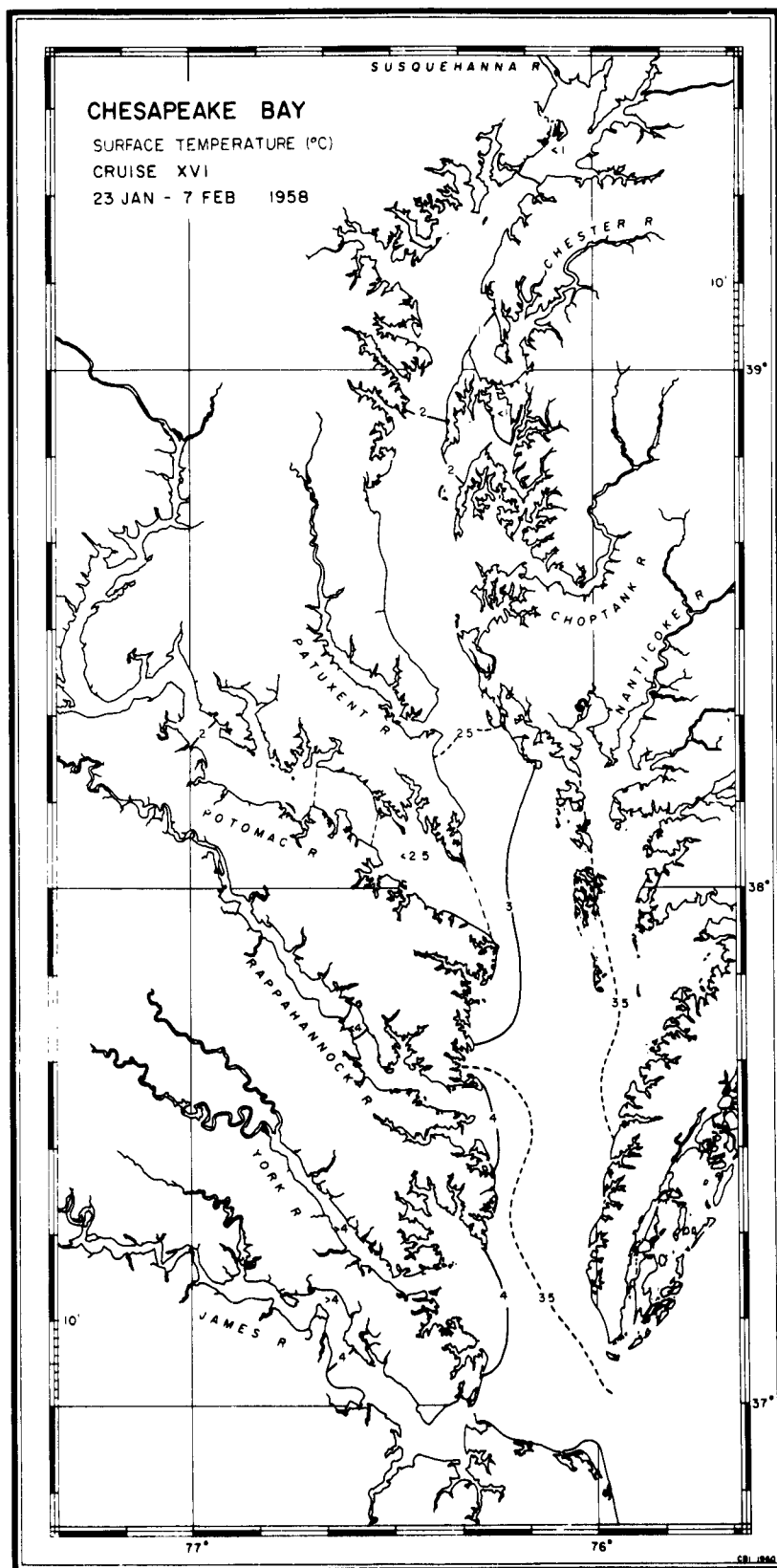


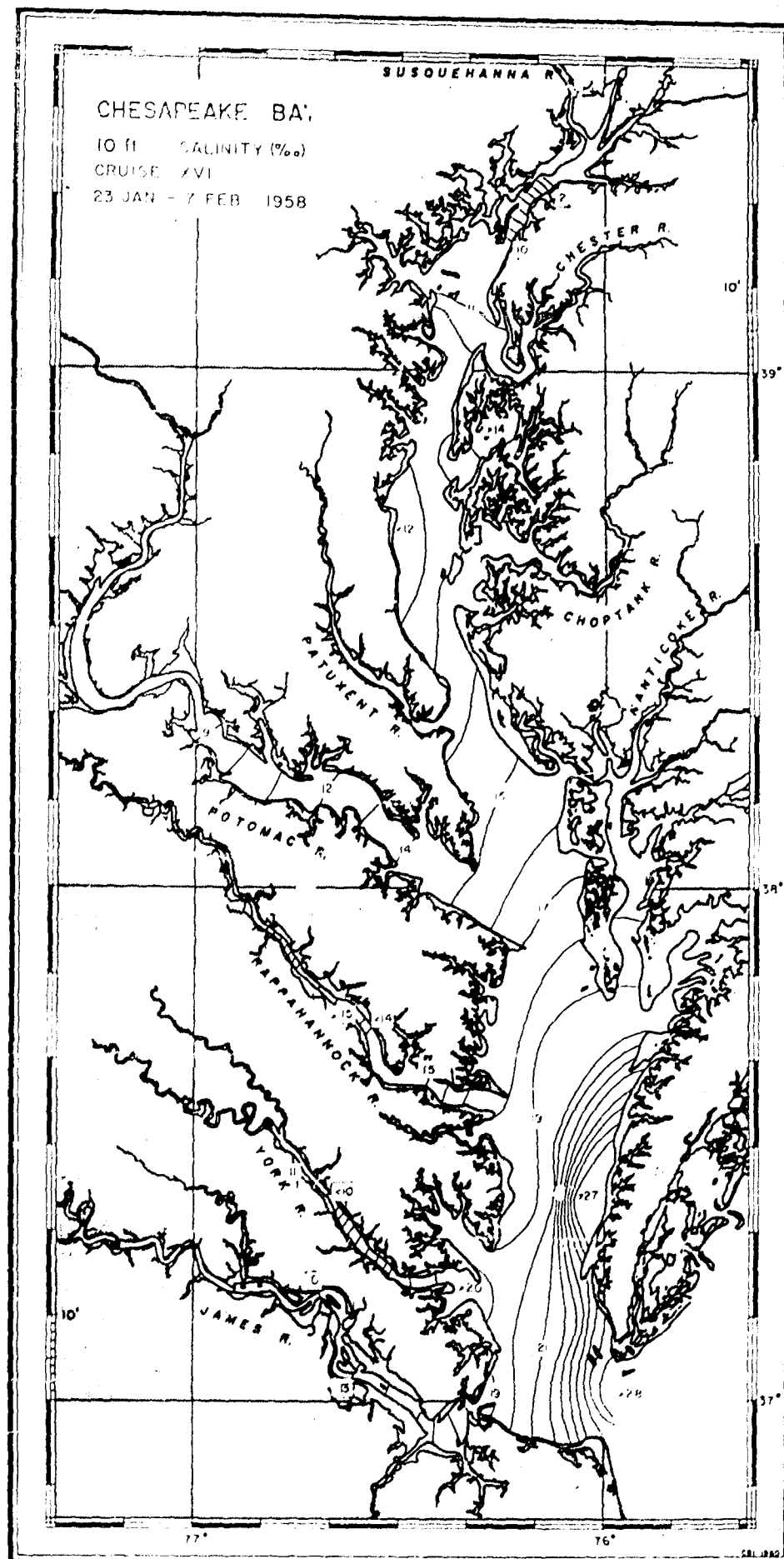
CRUISE XV II - 20 SEPTEMBER 1957 SECTION XIX
TEMPERATURE (°C)

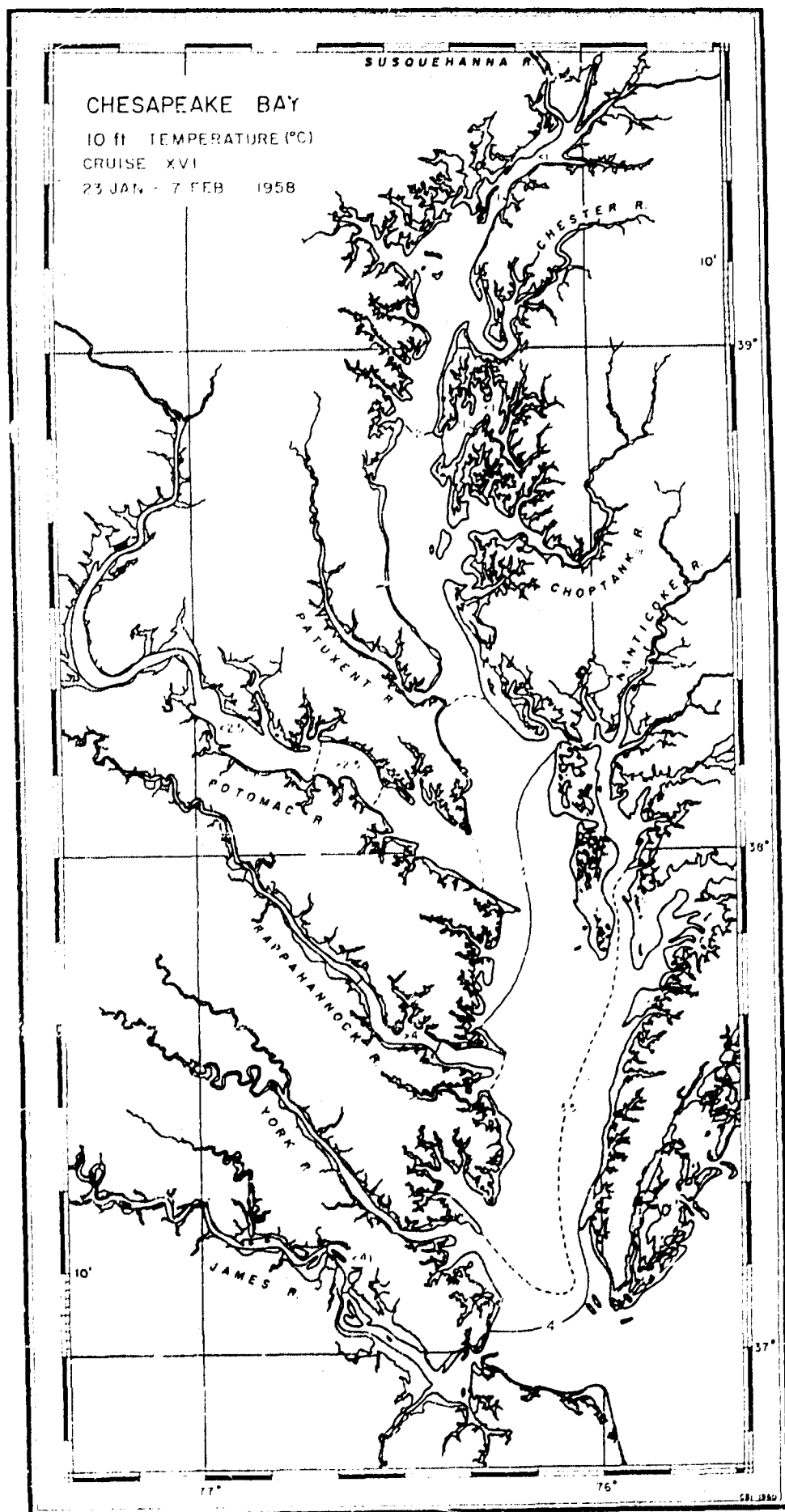


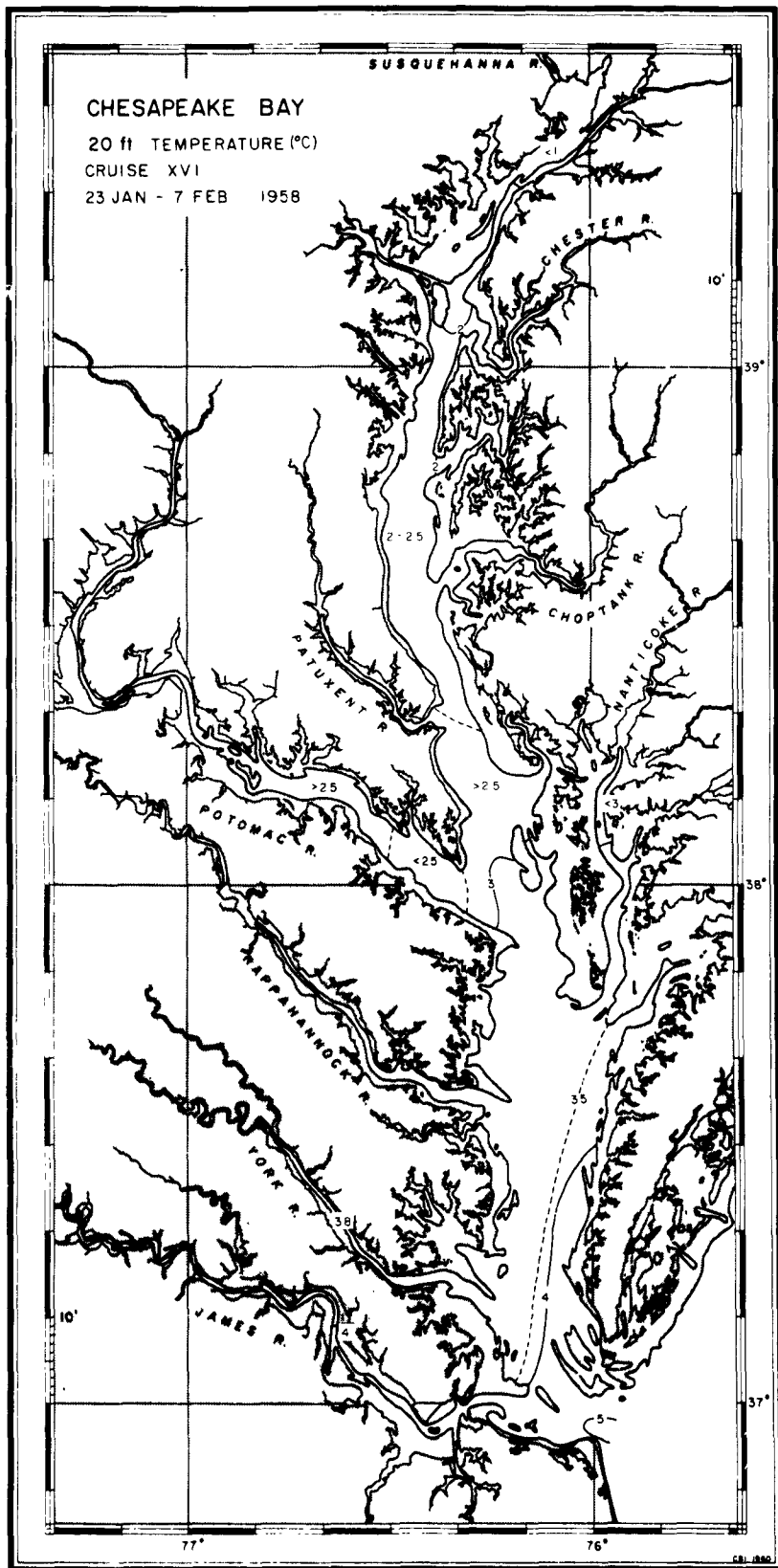


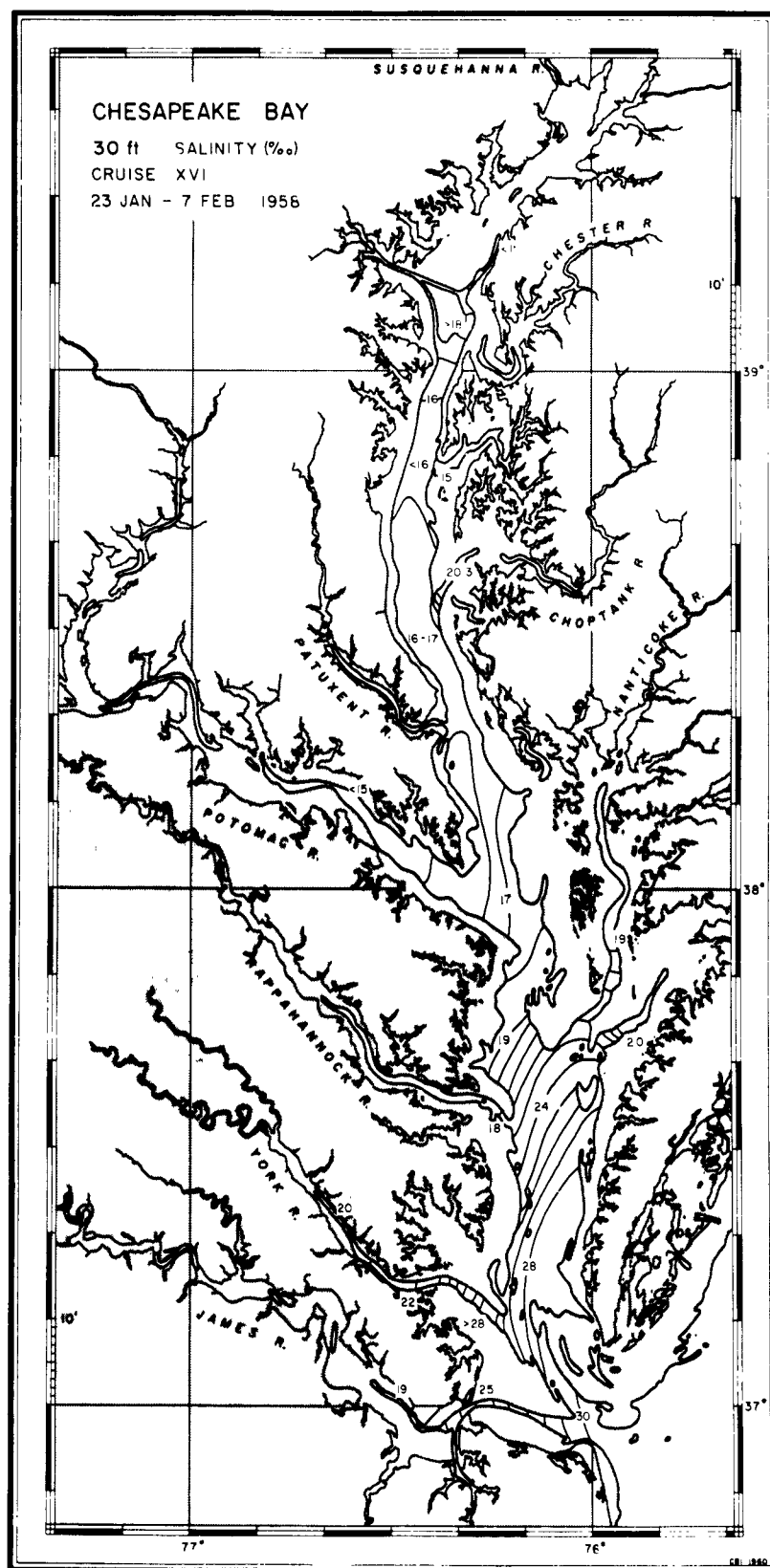


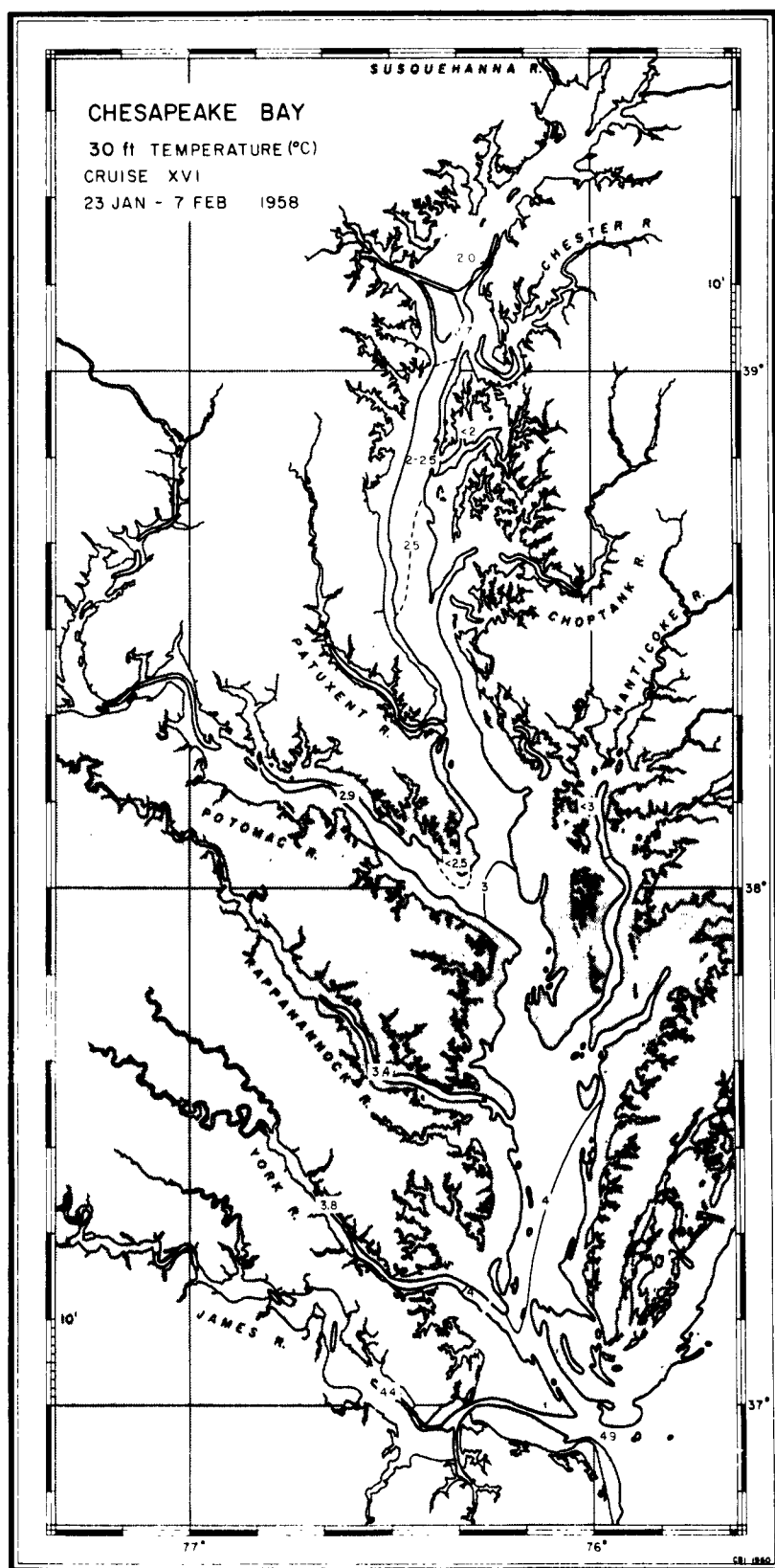


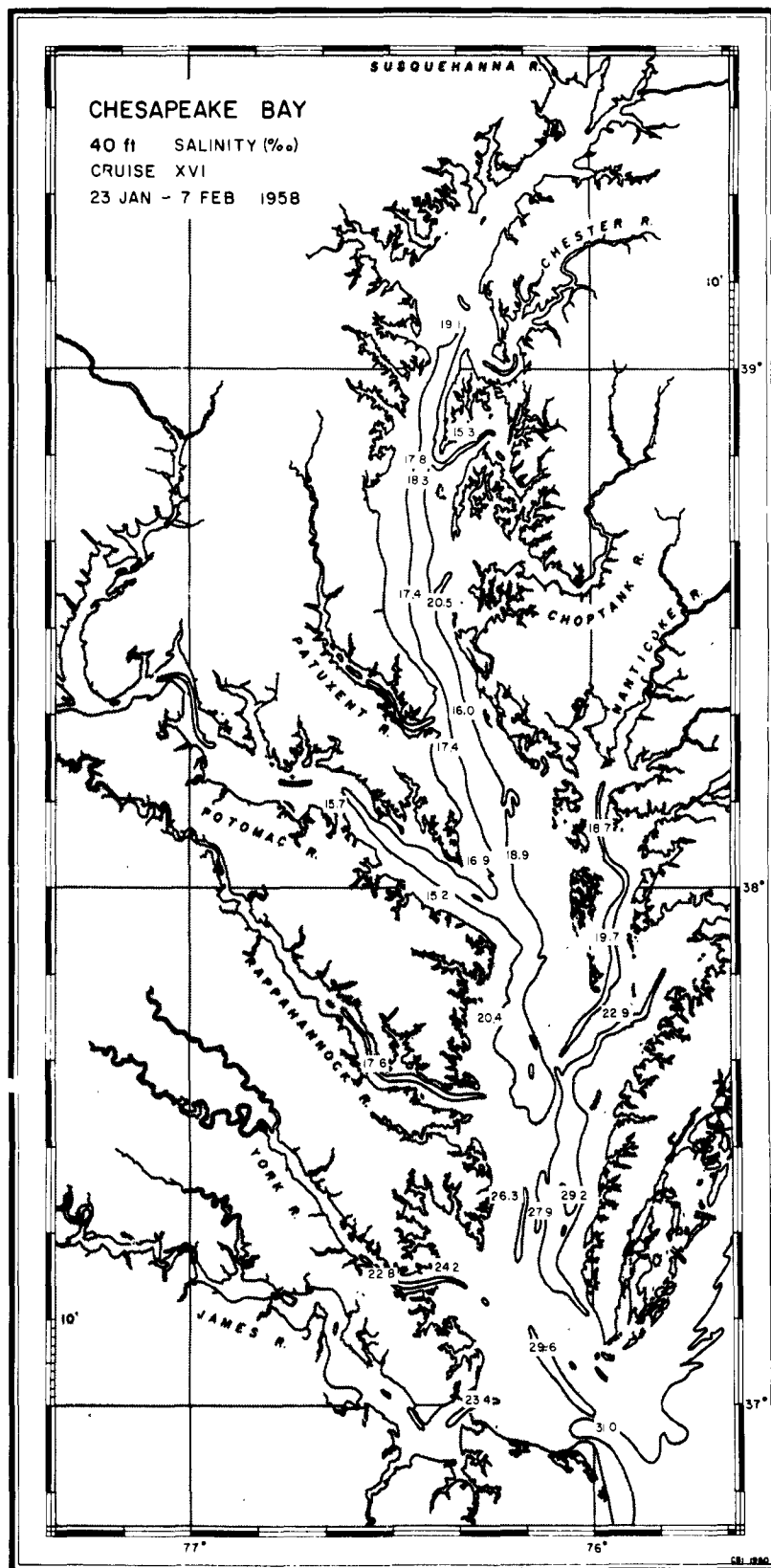


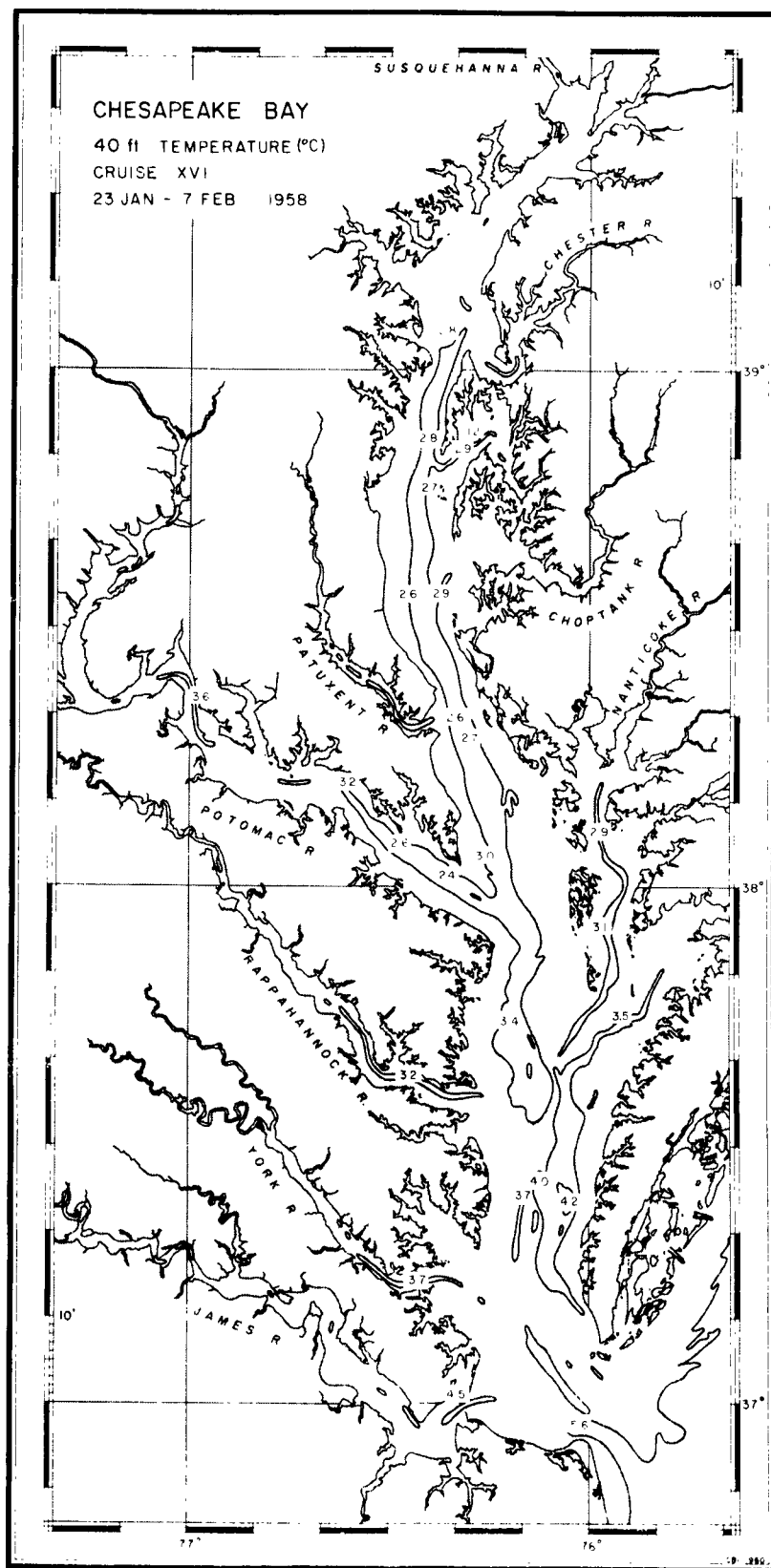


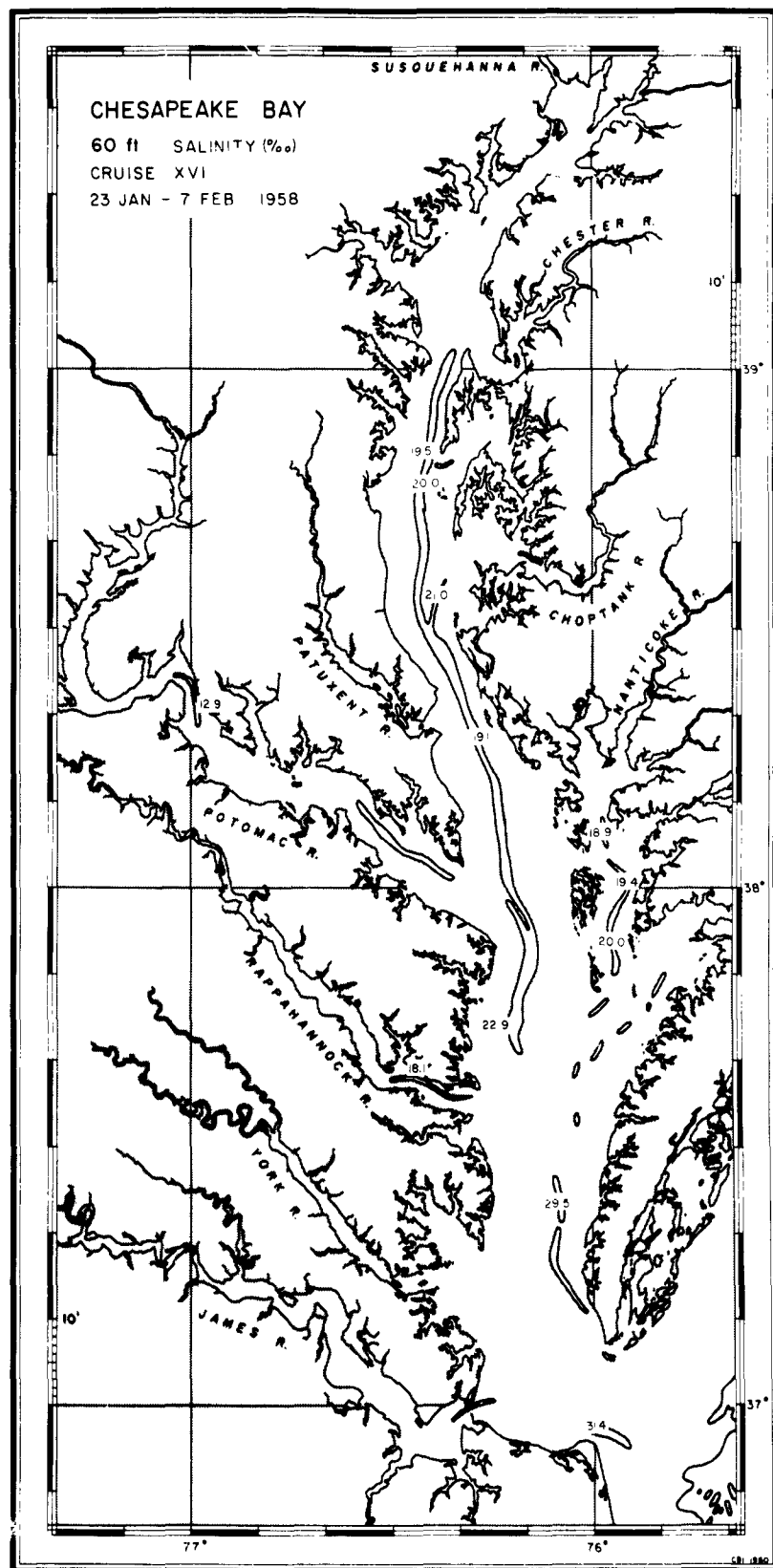


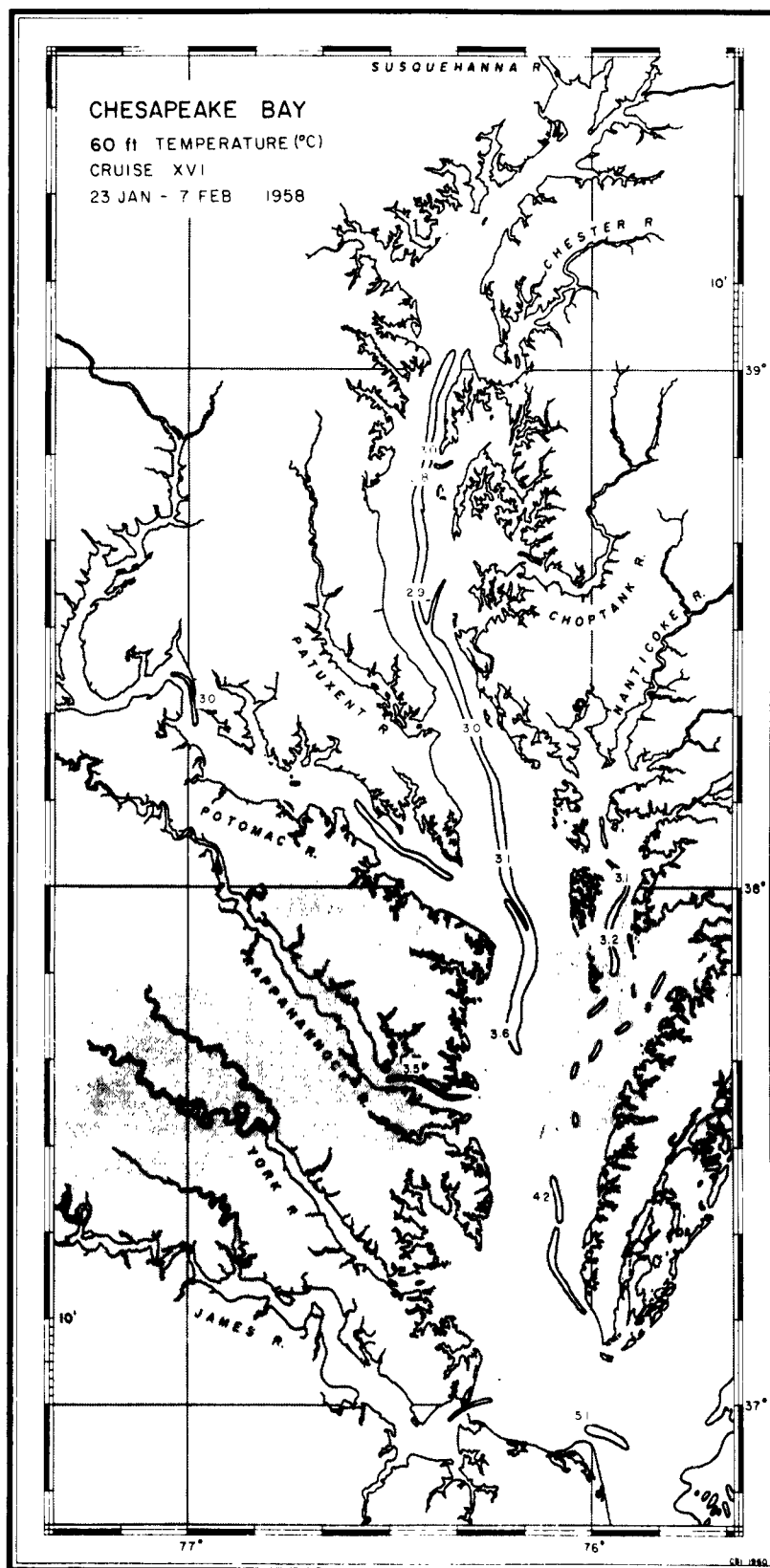




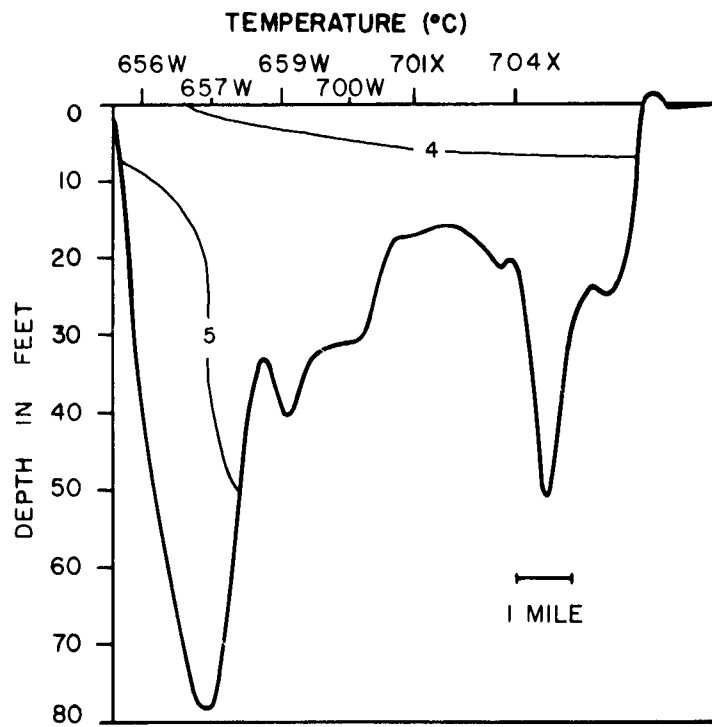
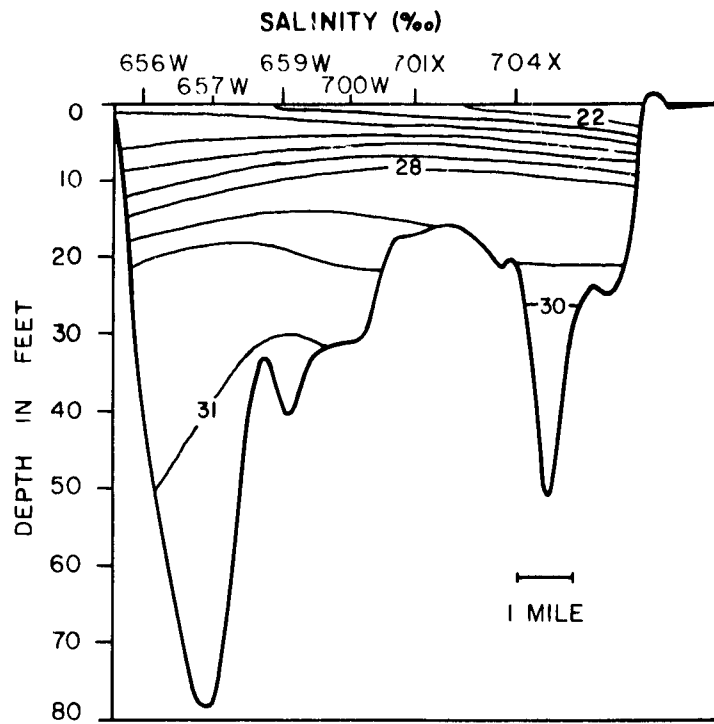




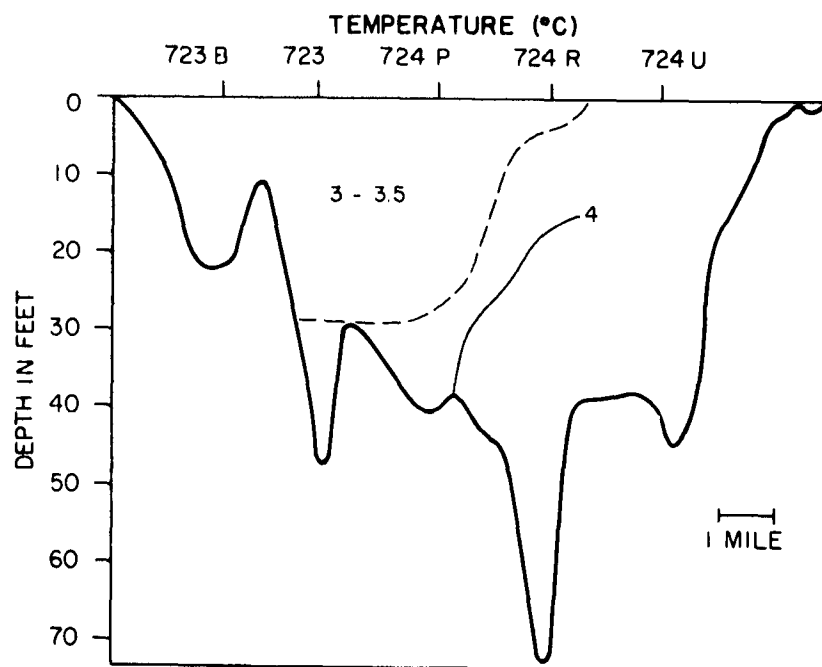
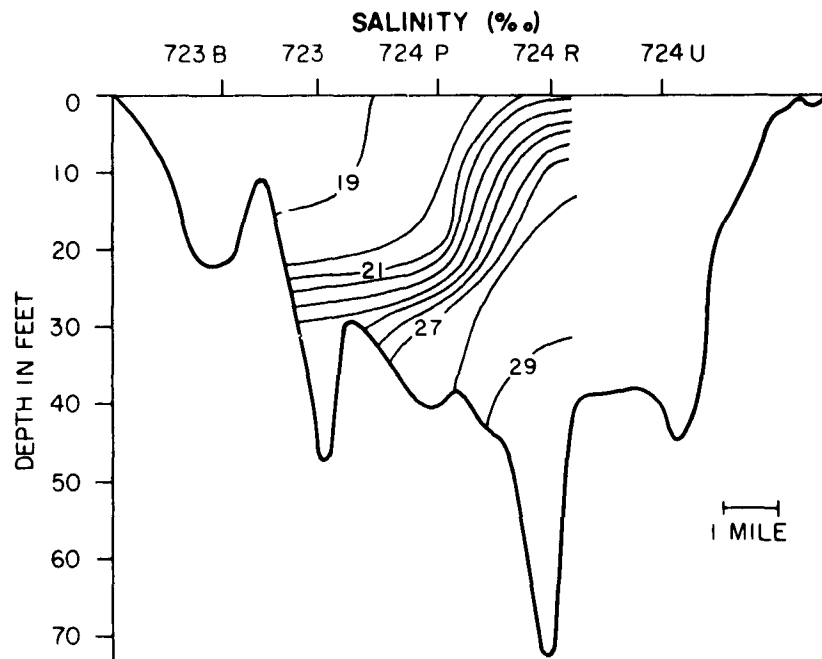




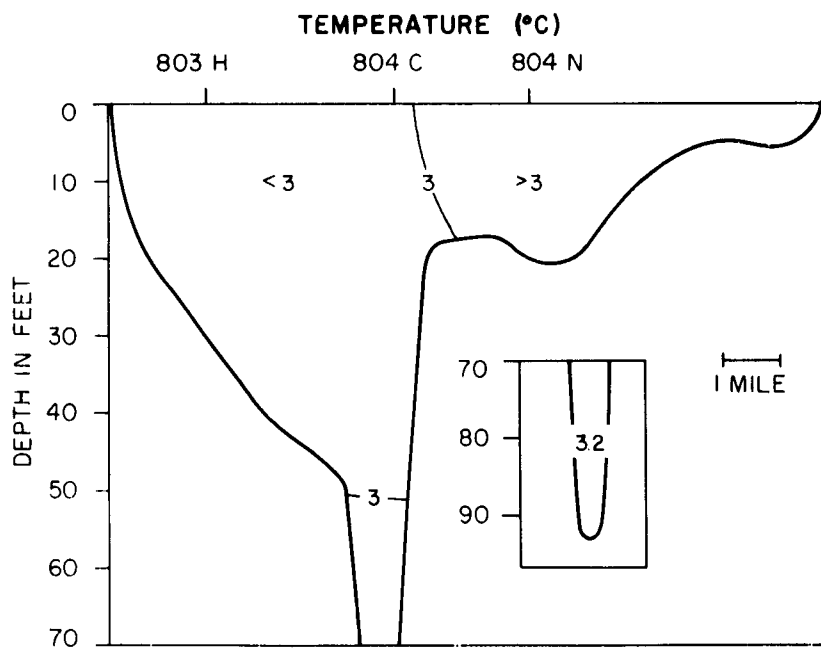
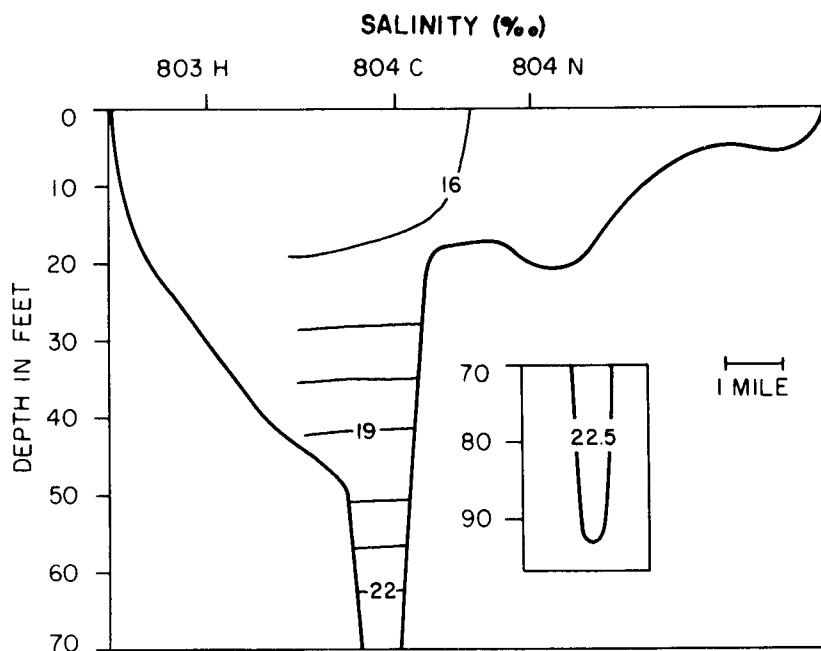
CRUISE XVI 23 JAN - 7 FEB 1958 SECTION II



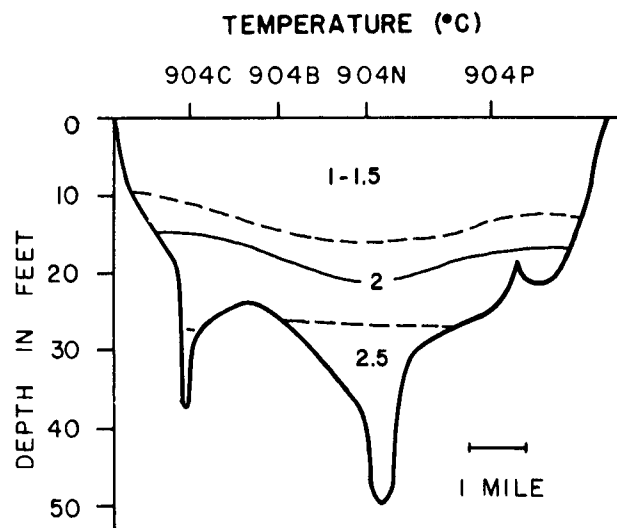
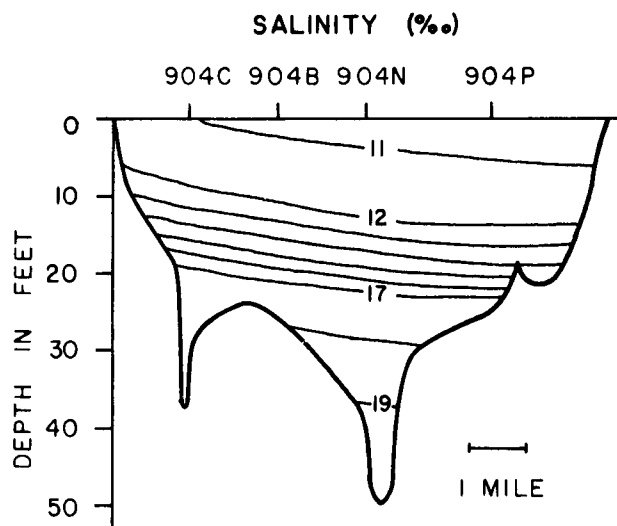
CRUISE XVI 23 JAN - 7 FEB 1958 SECTION IV



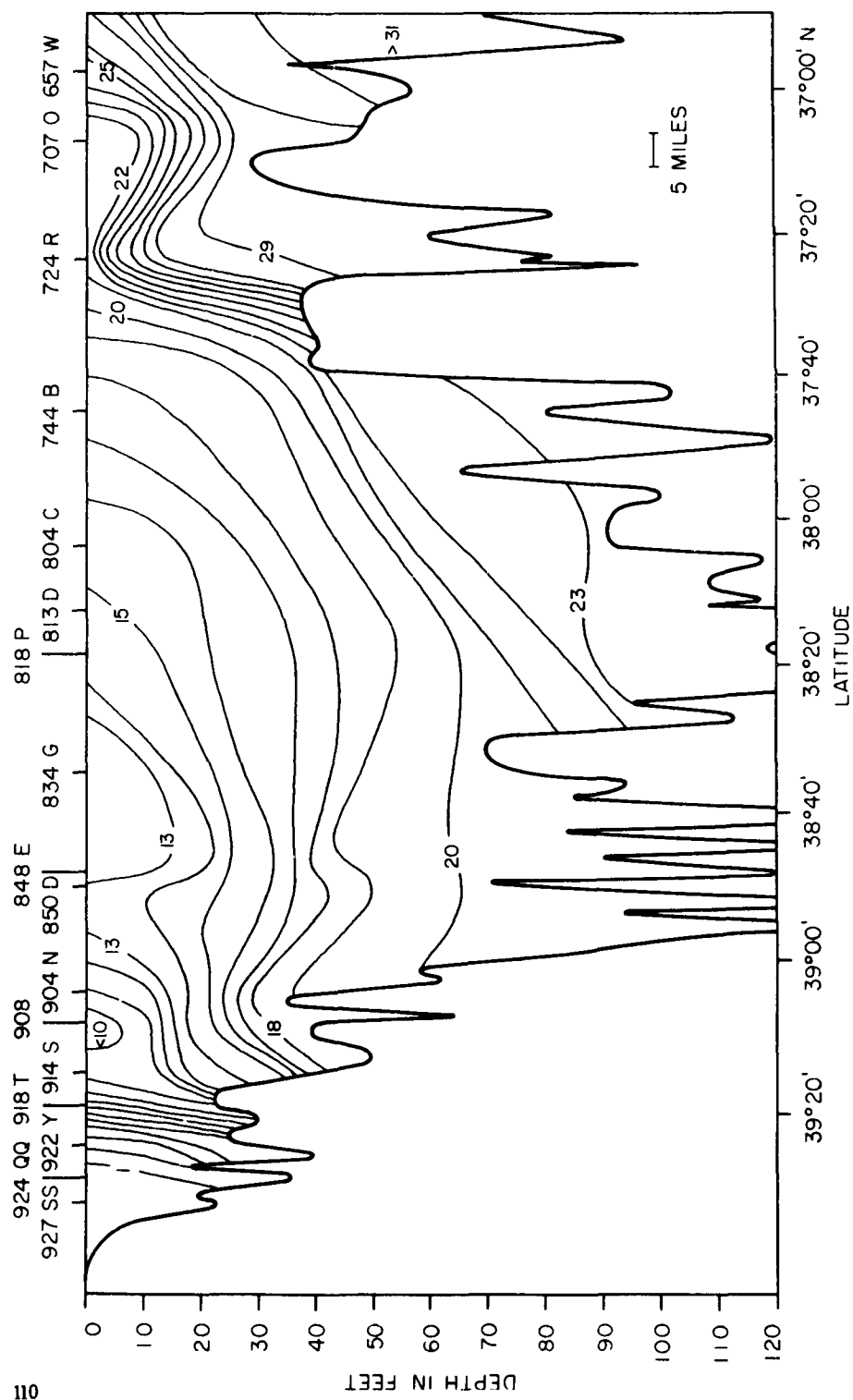
CRUISE XVI 23 JAN - 7 FEB 1958 SECTION VI



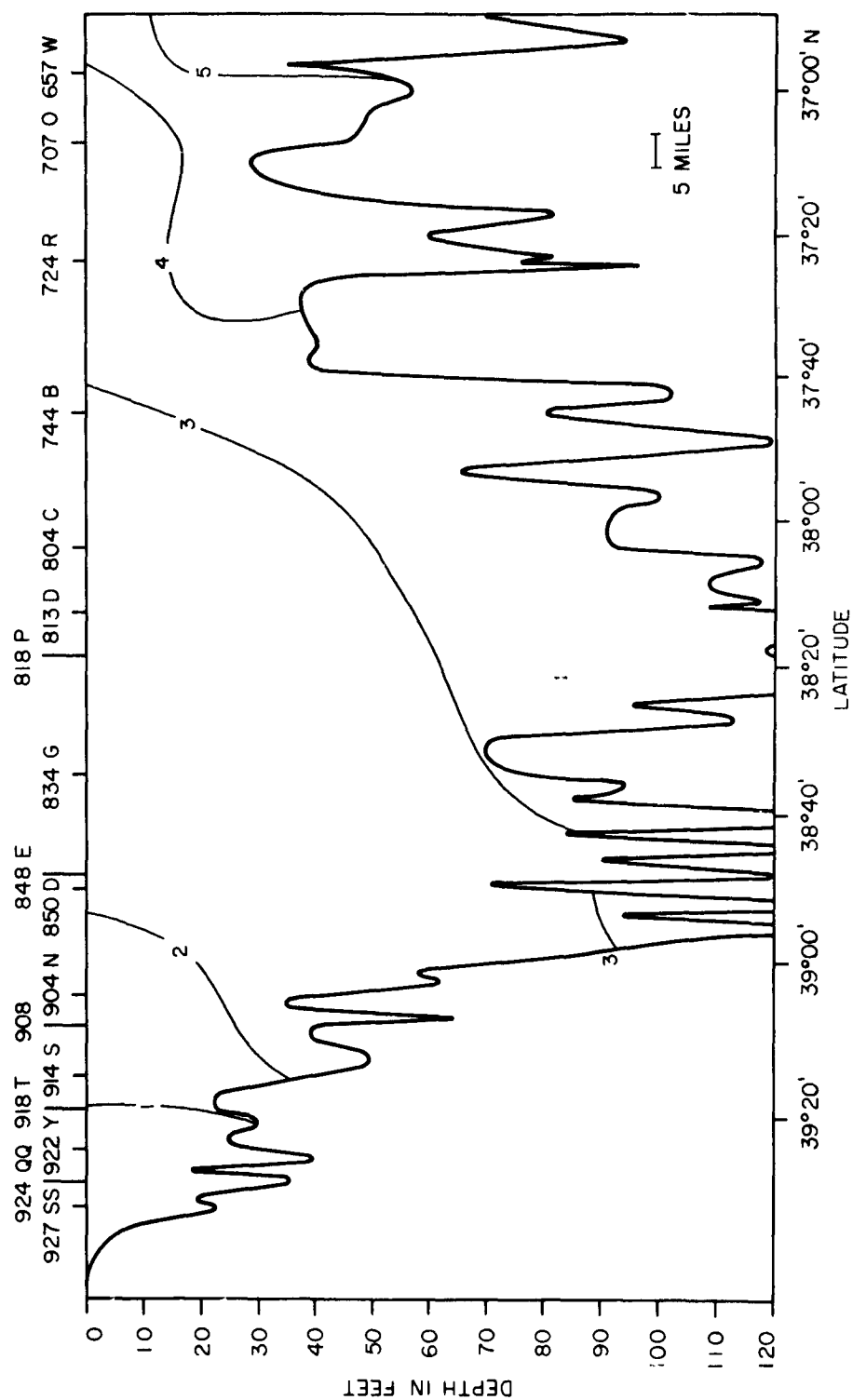
CRUISE XVI 23 JAN - 7 FEB 1958 SECTION X

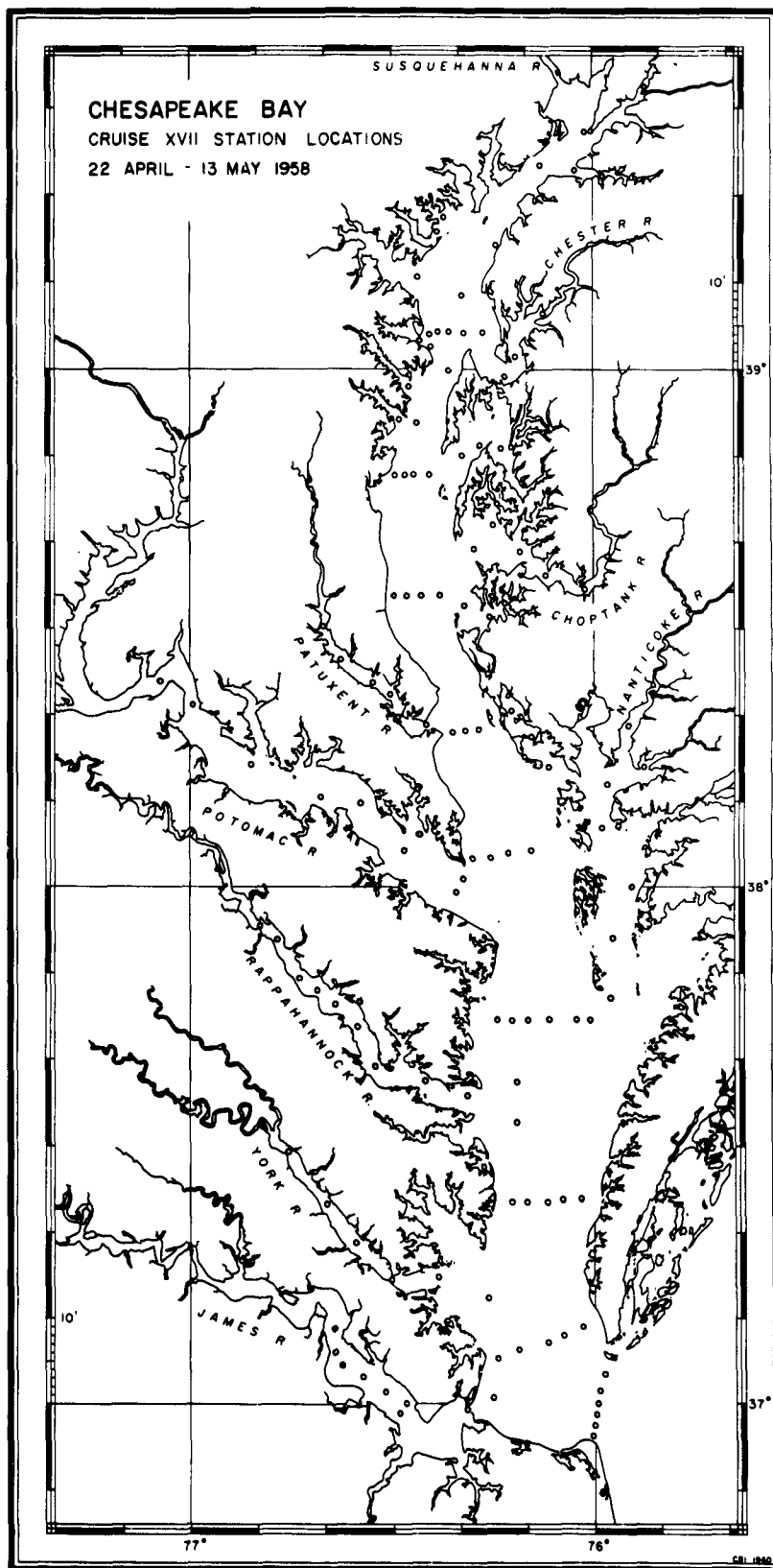


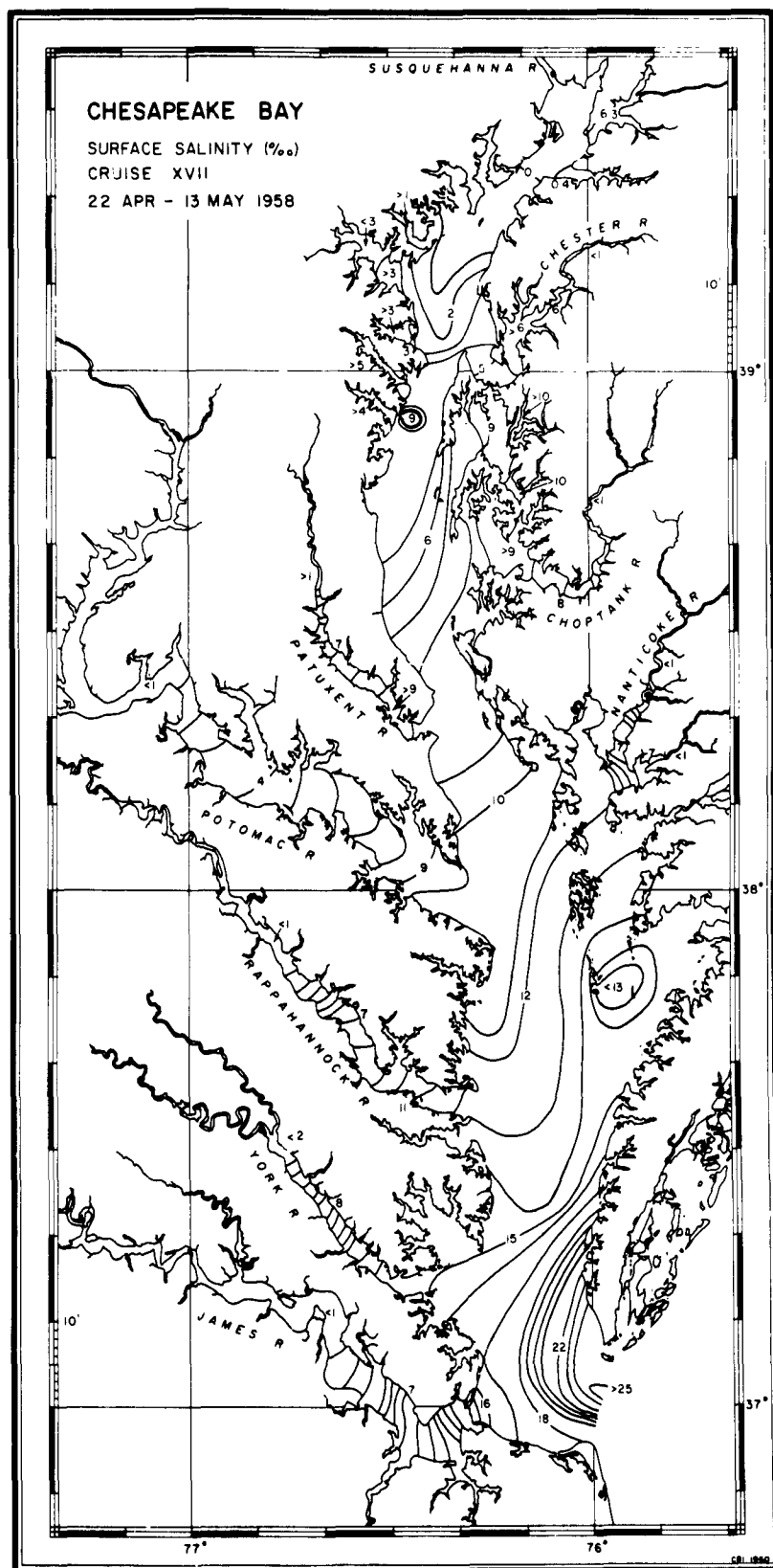
CRUISE XVI 23 JAN - 7 FEB 1958 SECTION XIX
SALINITY (‰)

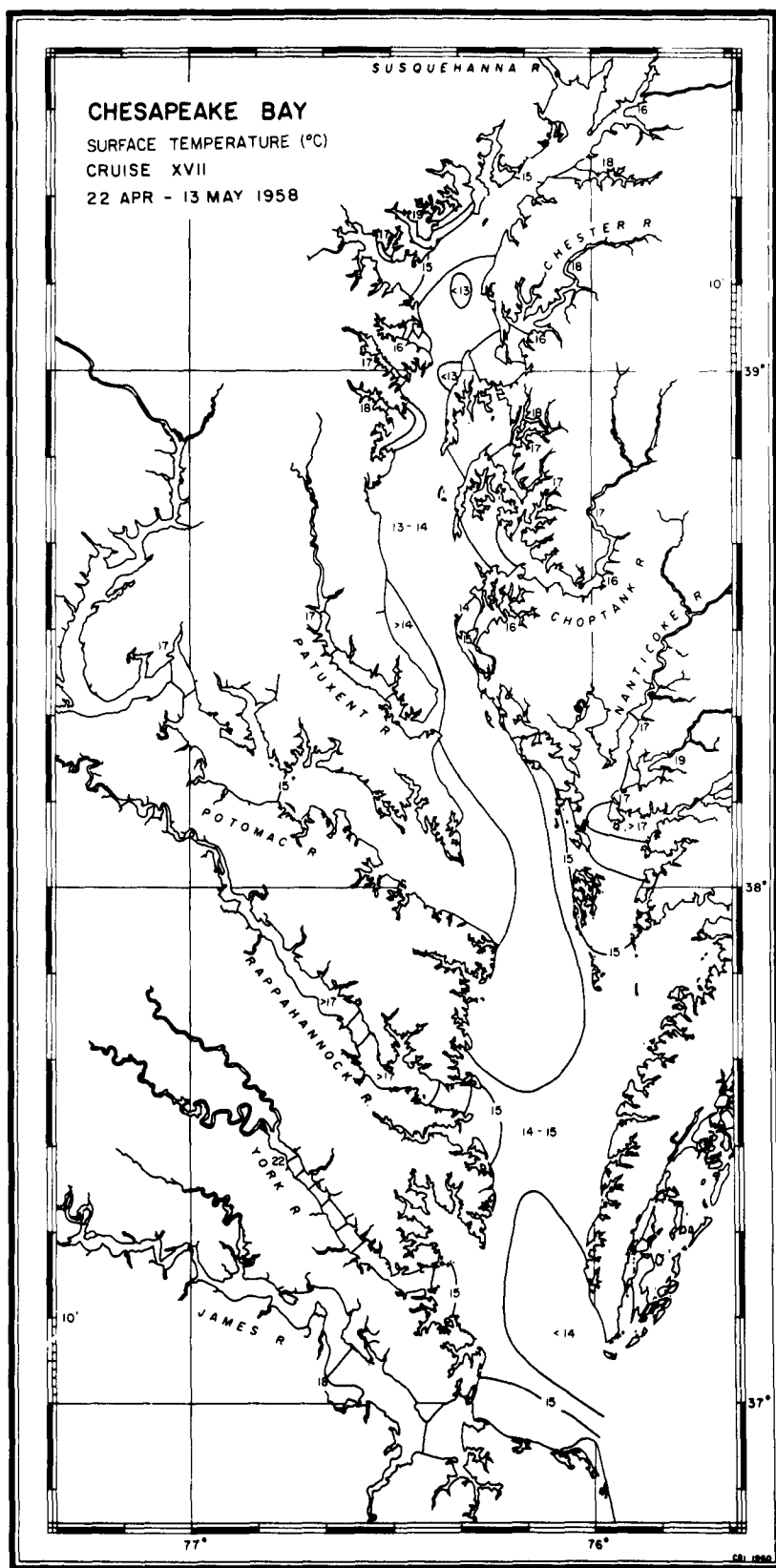


CRUISE XVI 23 JAN - 7 FEB 1958 SECTION XIX
TEMPERATURE (°C)







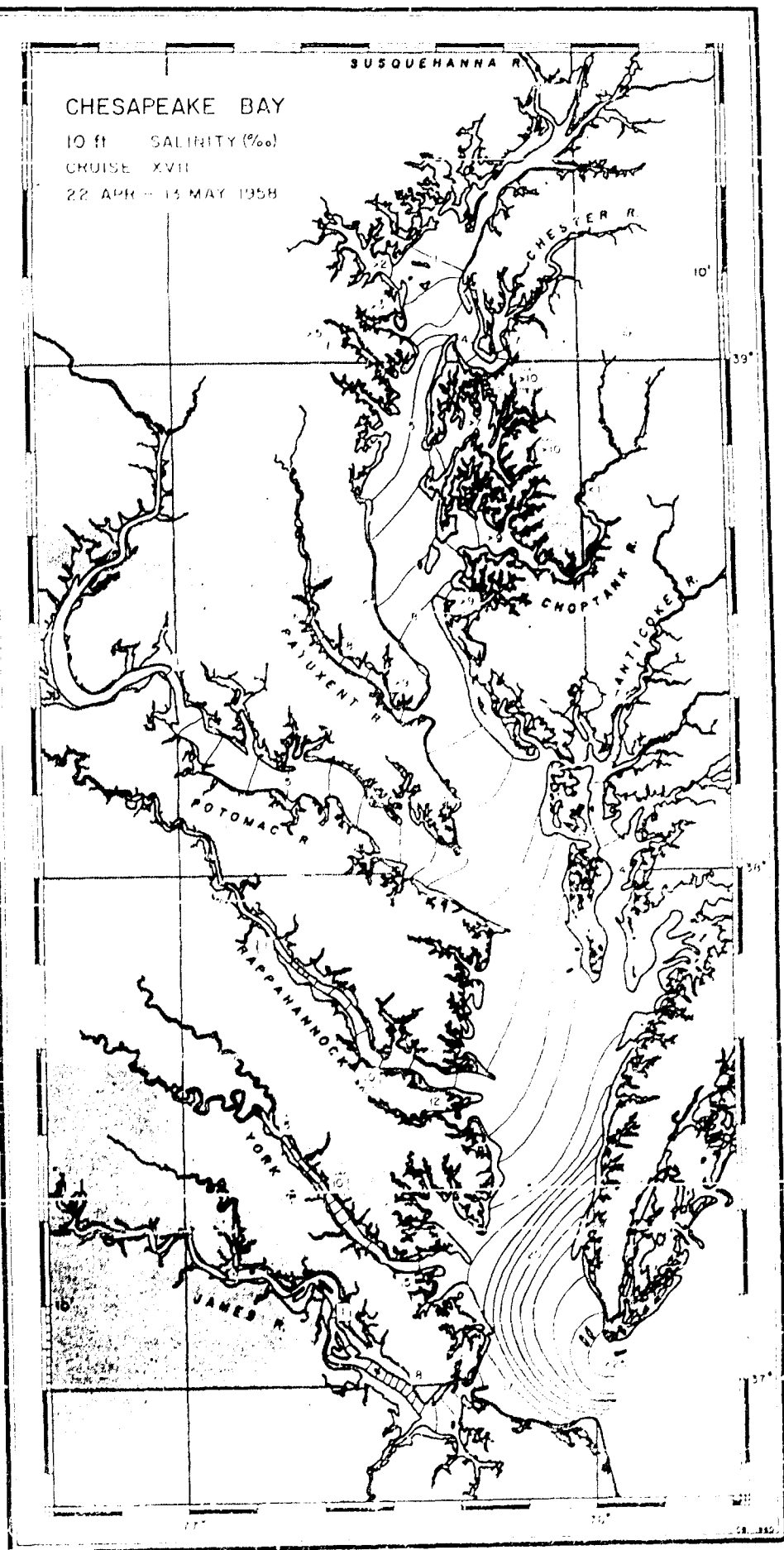


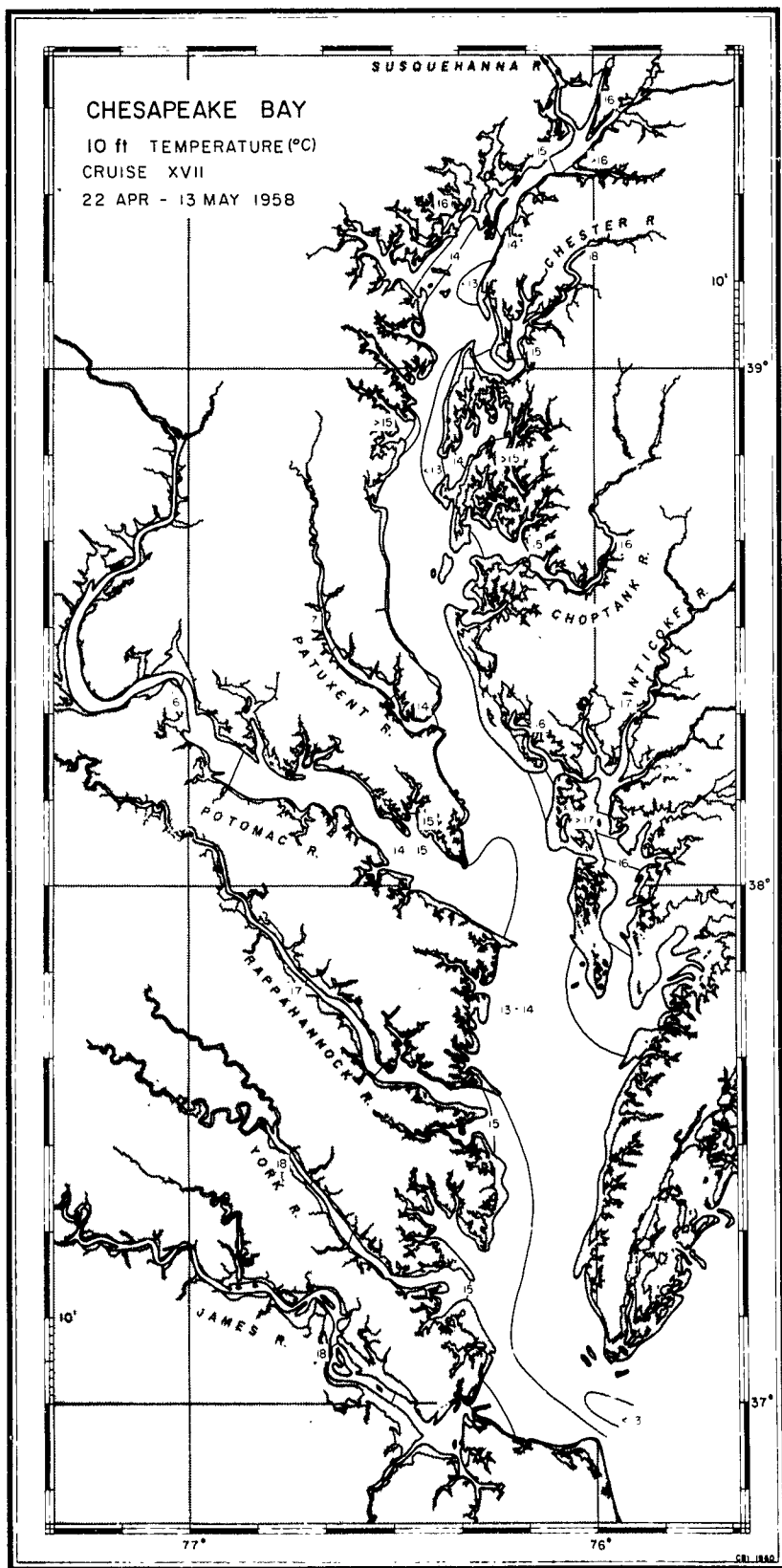
CHESAPEAKE BAY

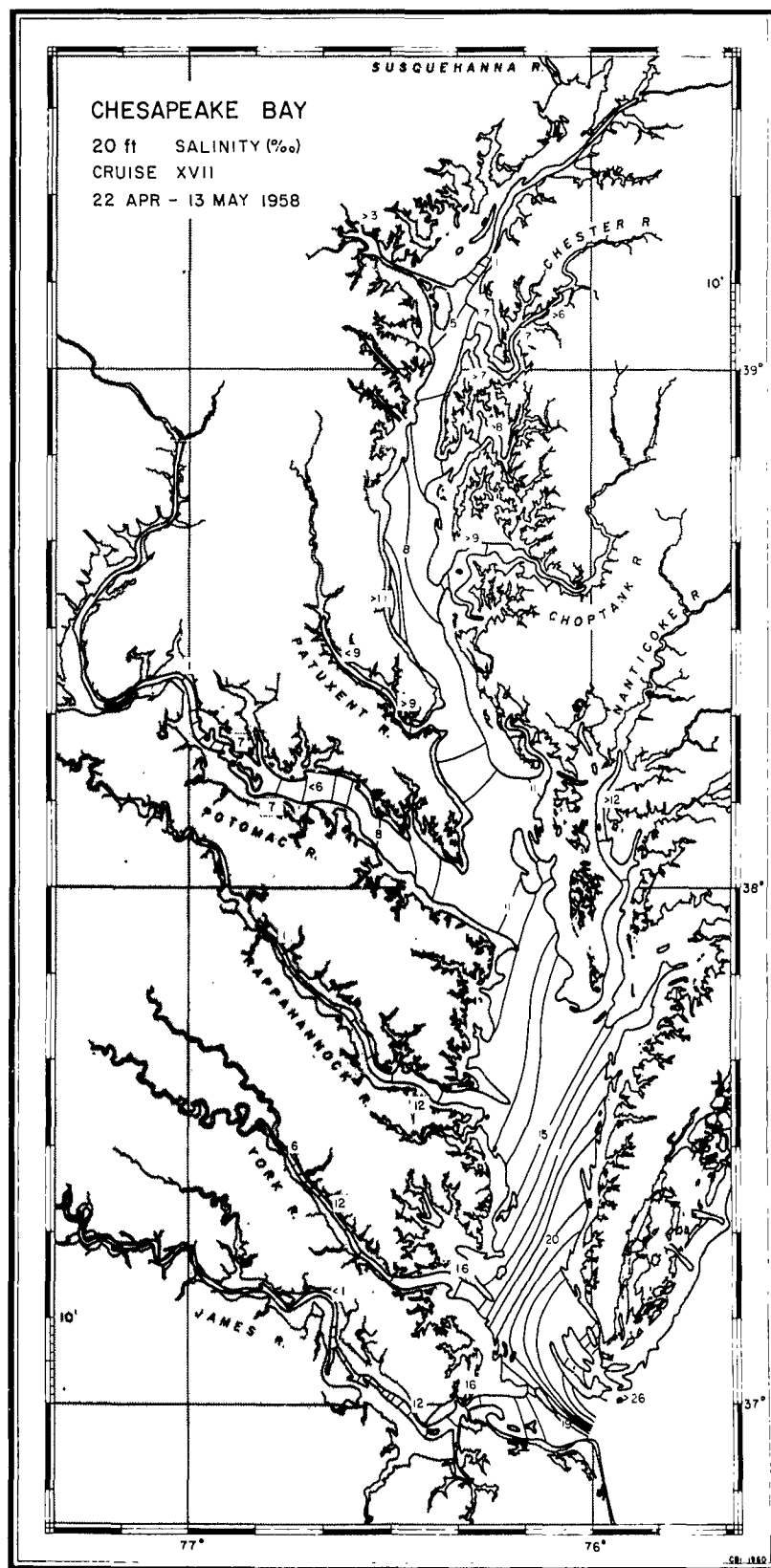
10 ft SALINITY (‰)

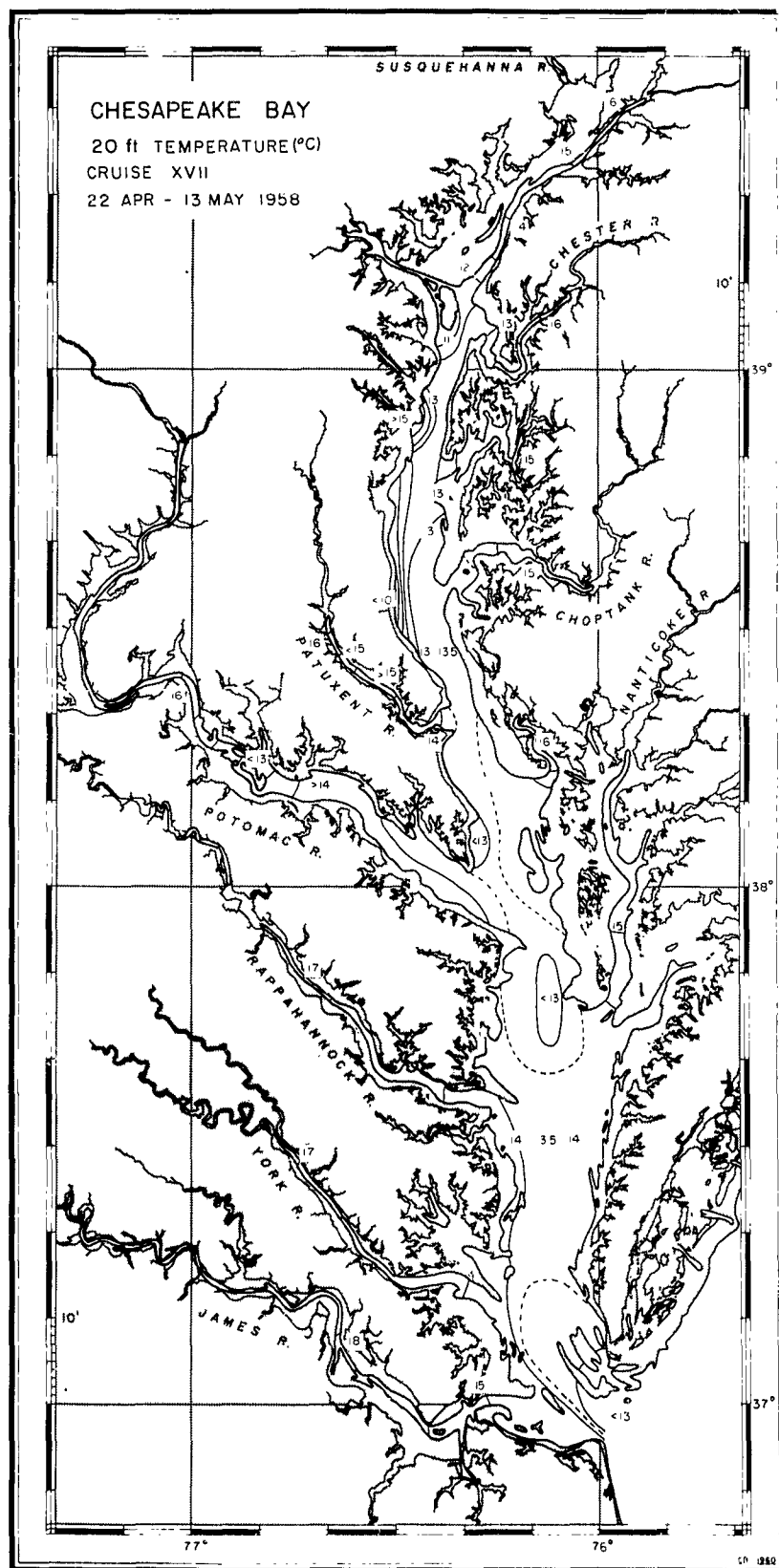
CRUISE XVII

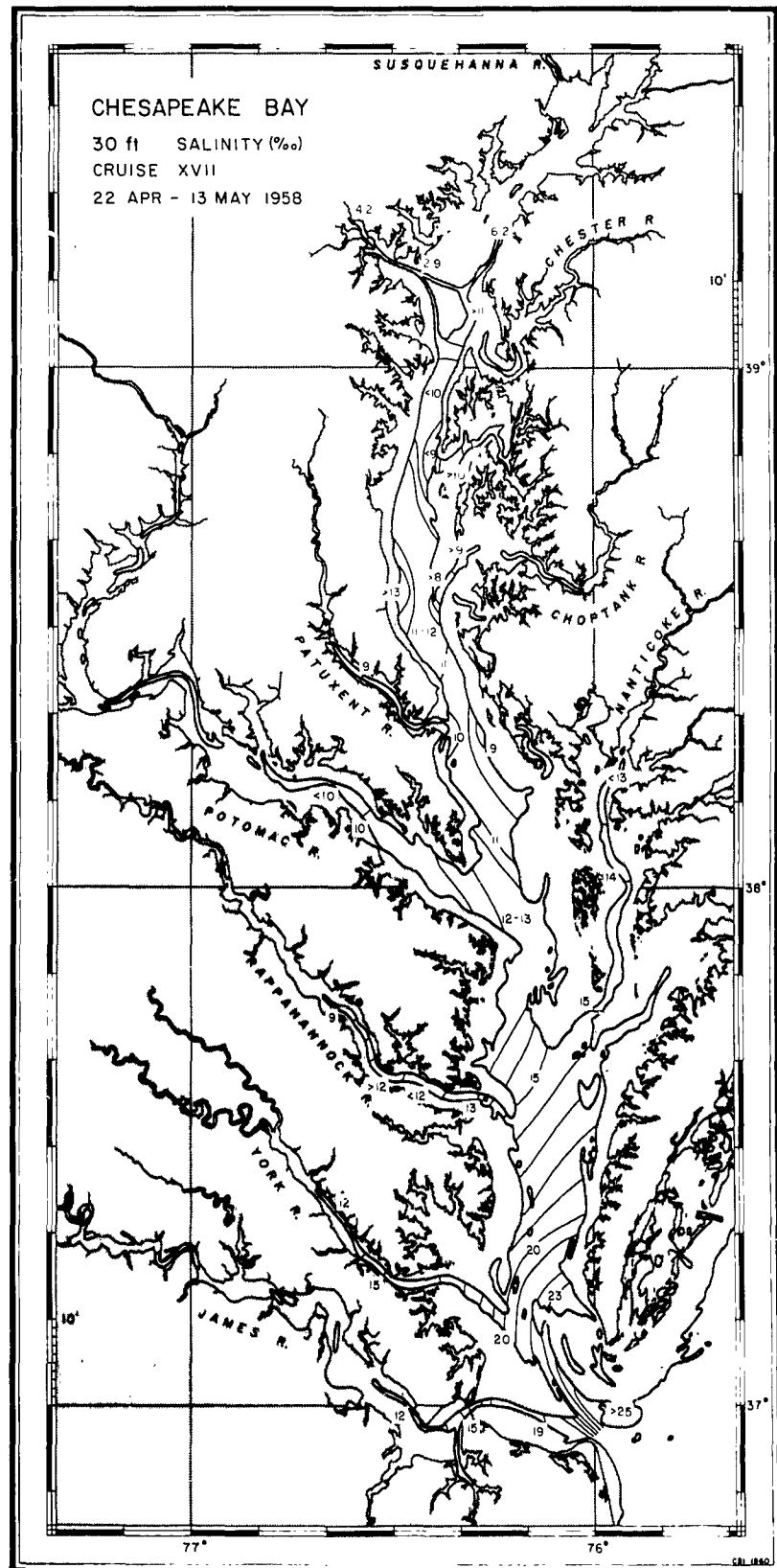
22 APR - 13 MAY 1958

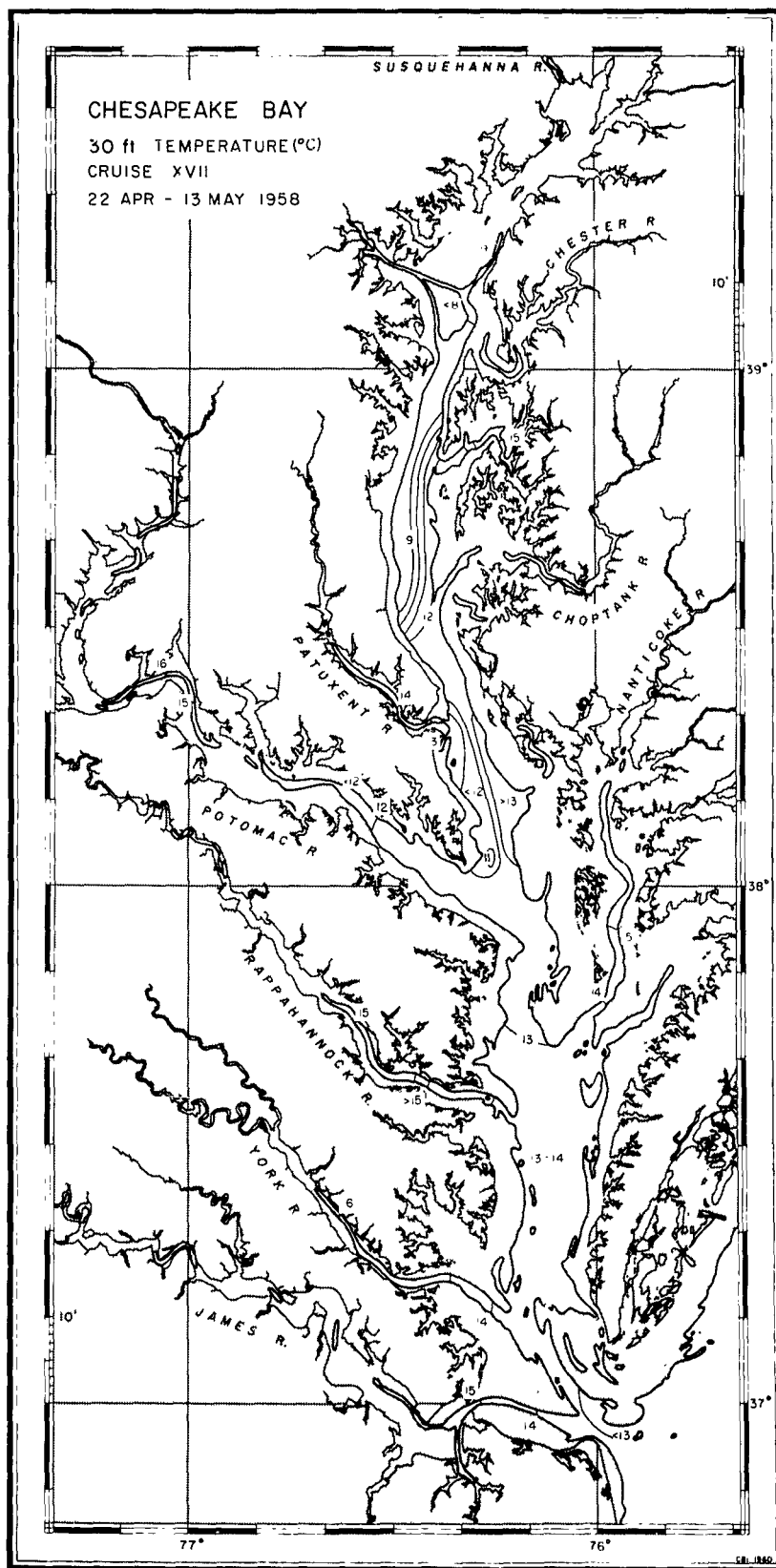


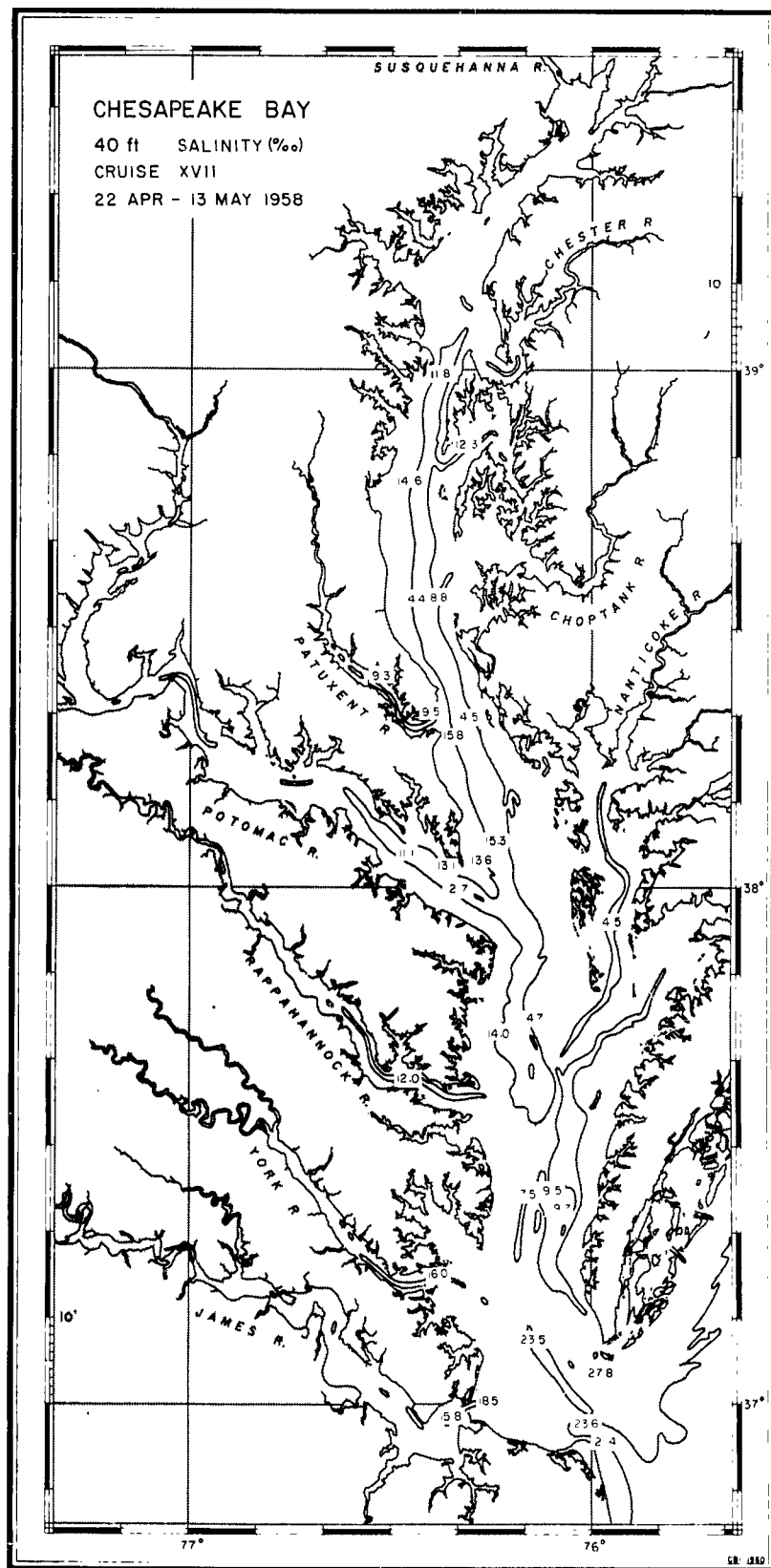


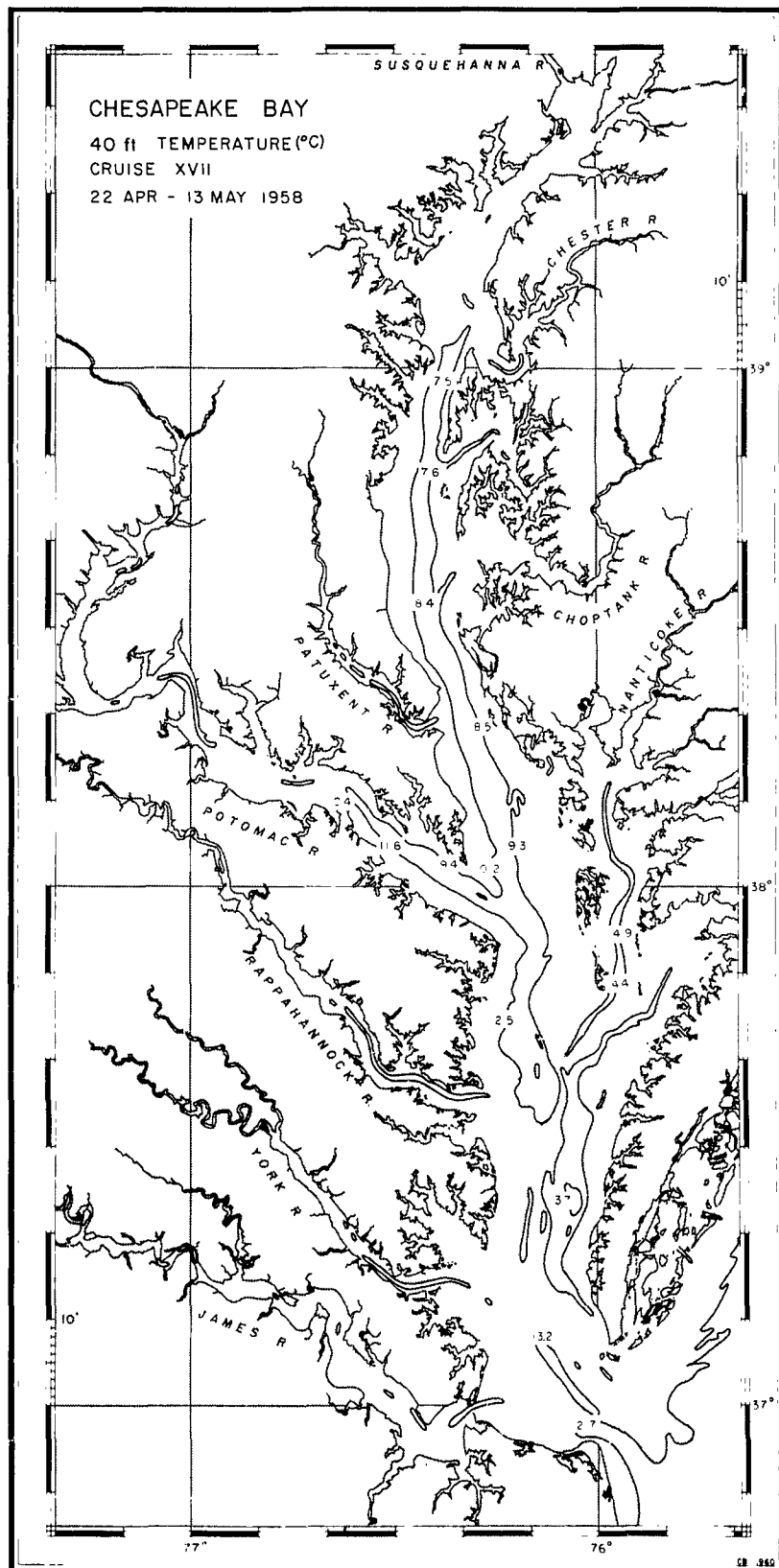


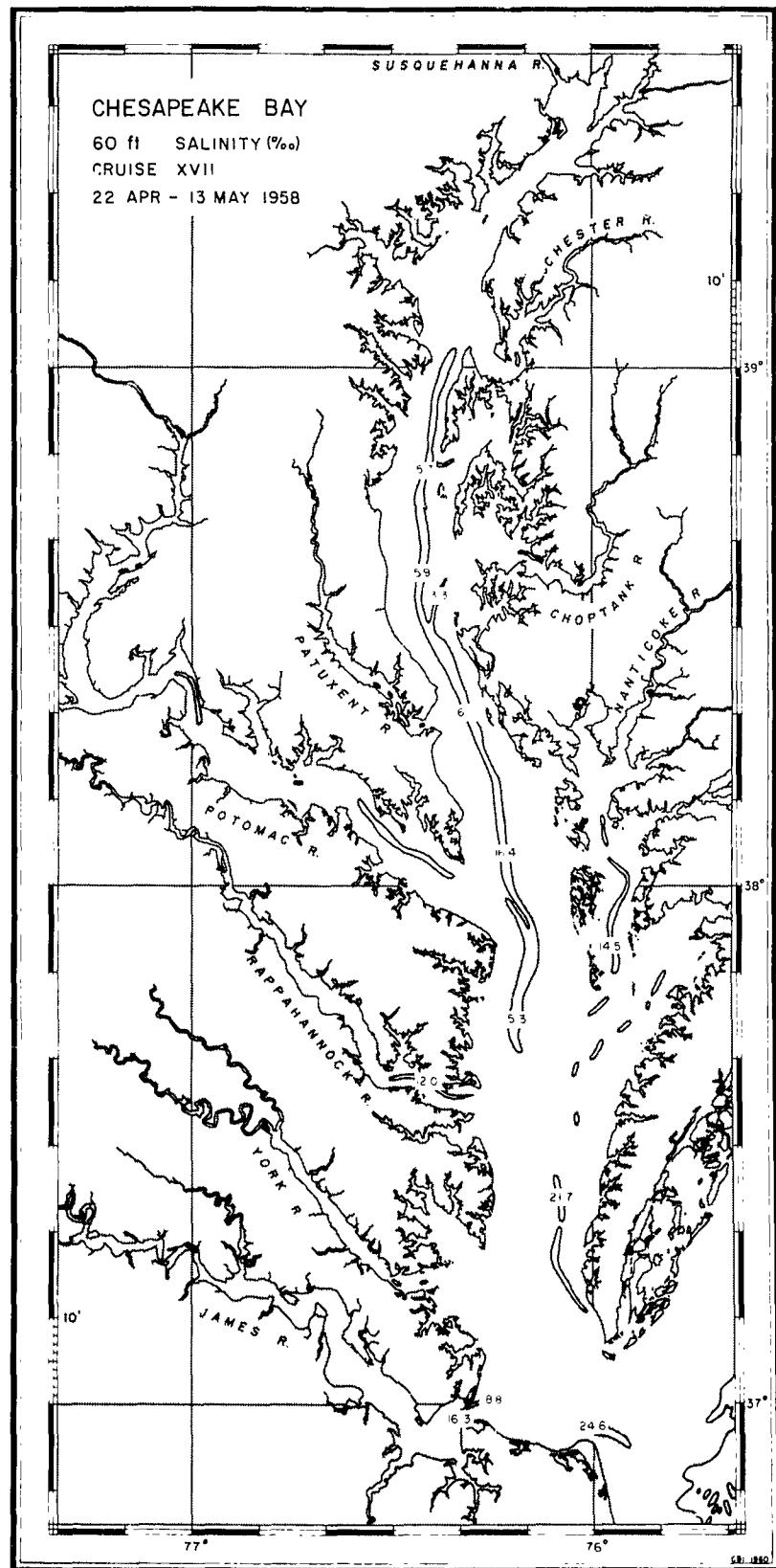


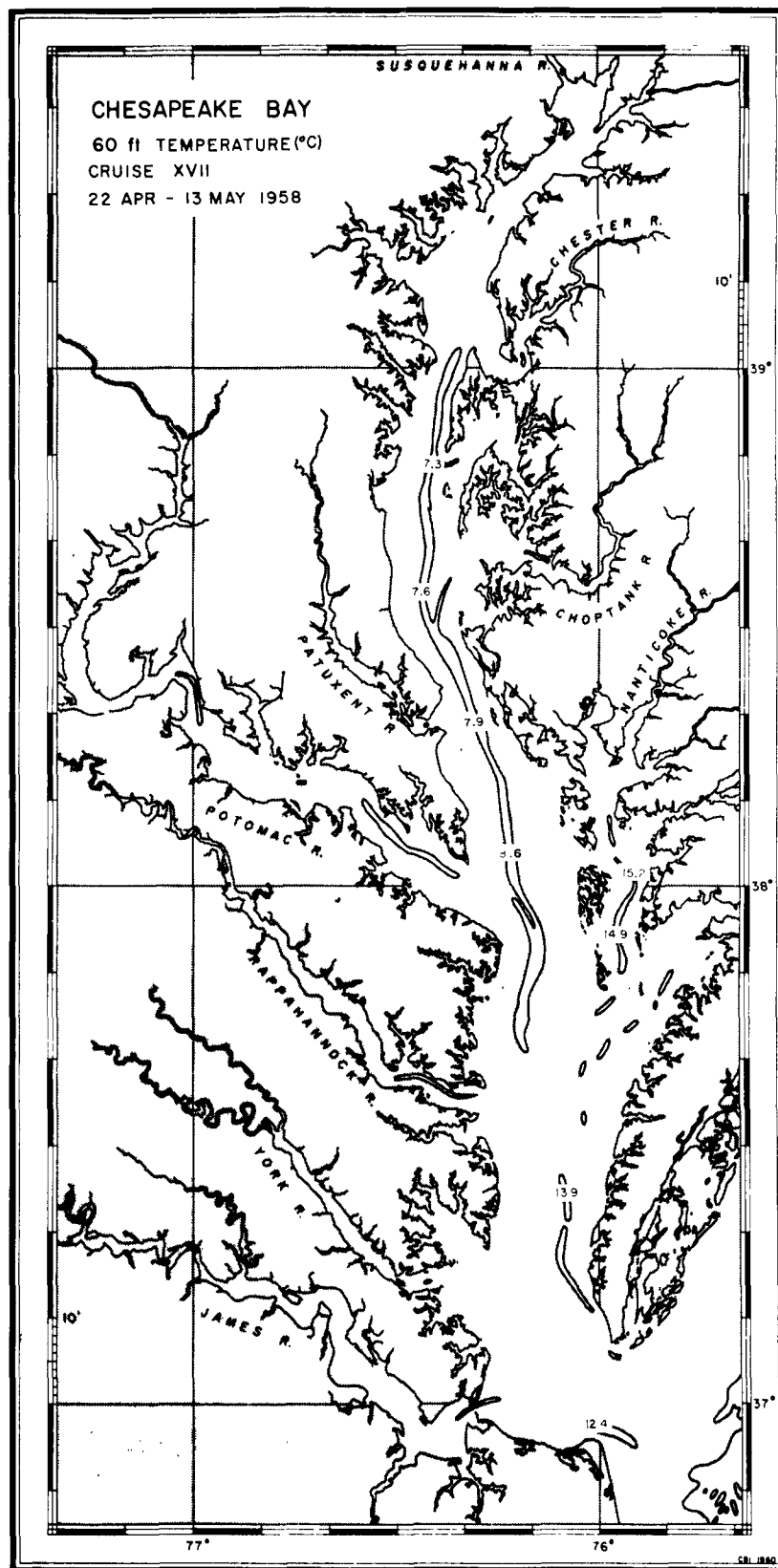




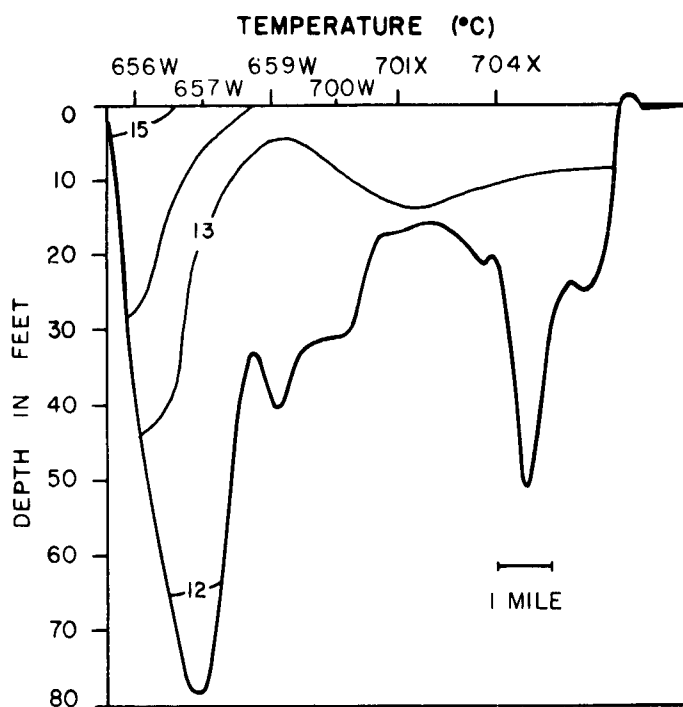
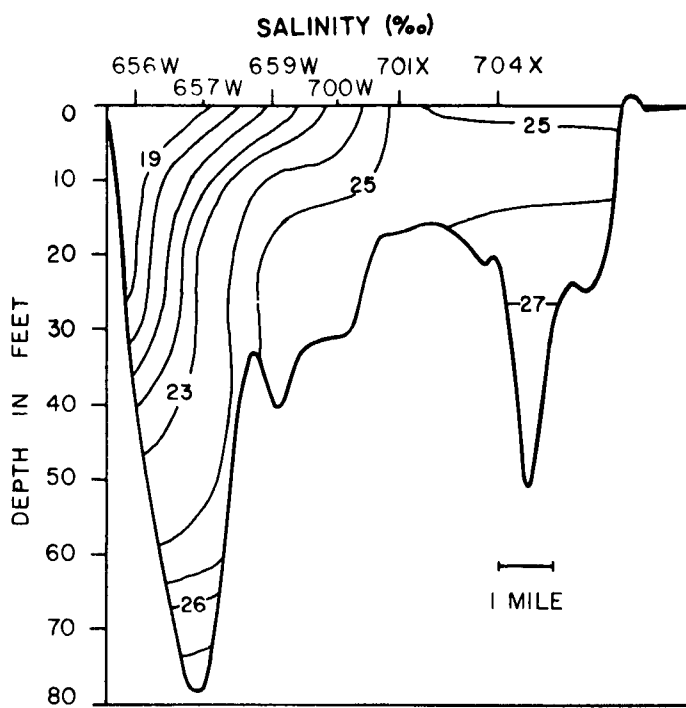




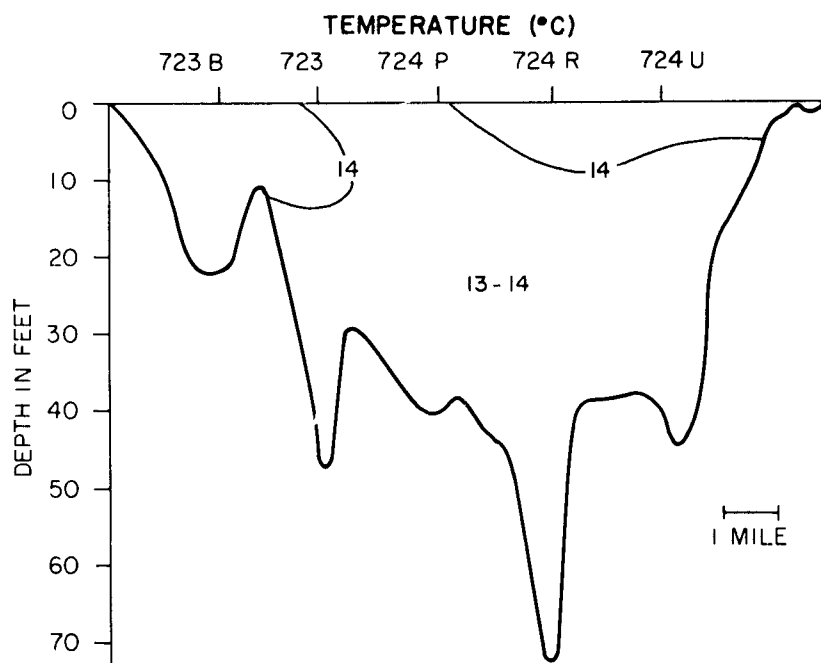
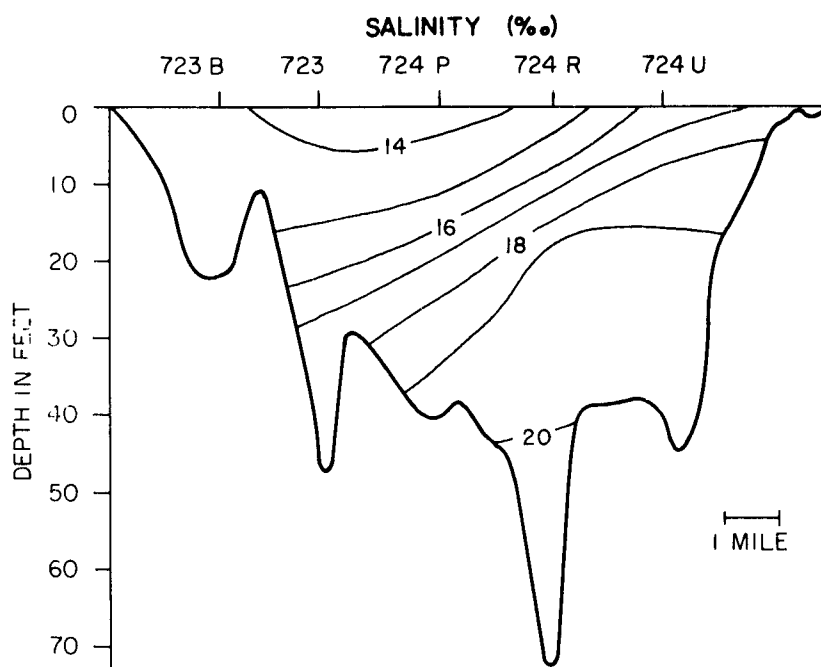




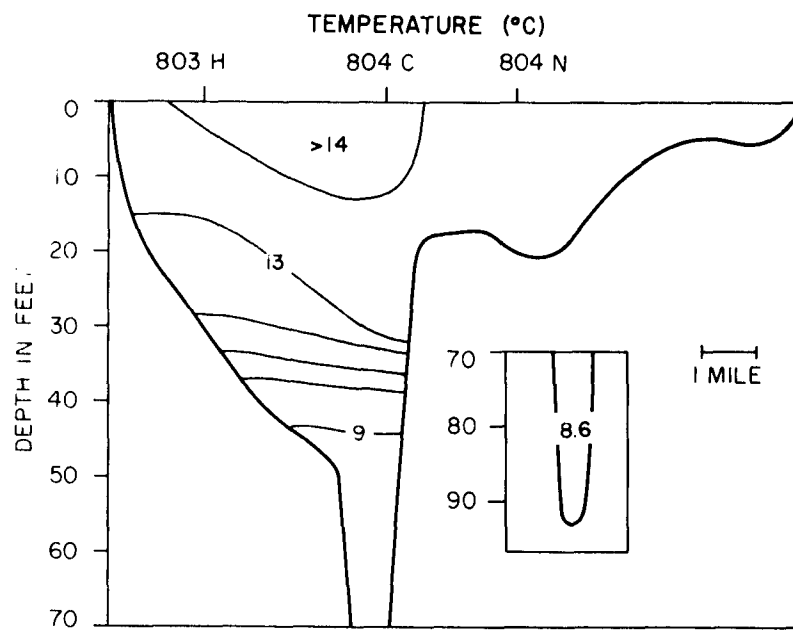
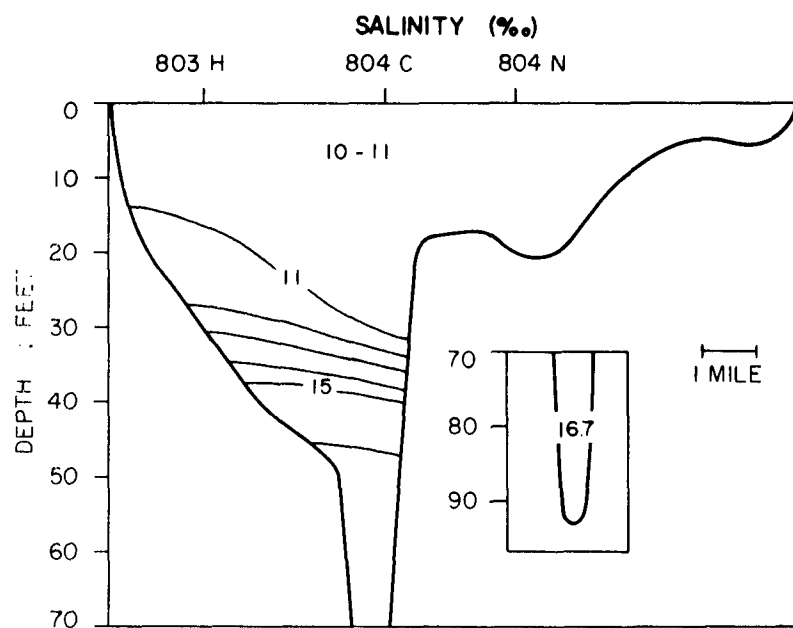
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION II



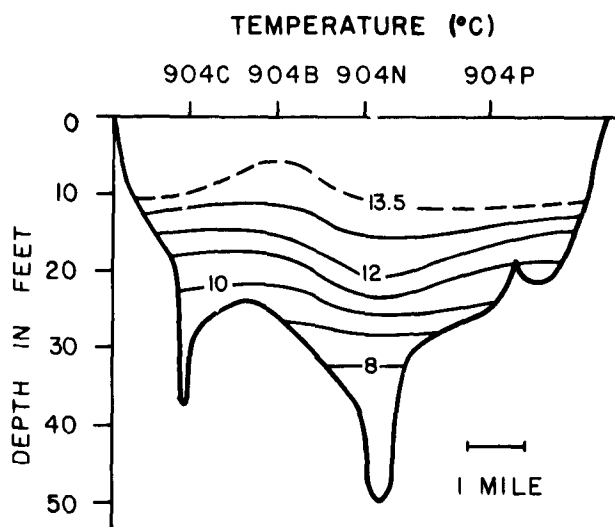
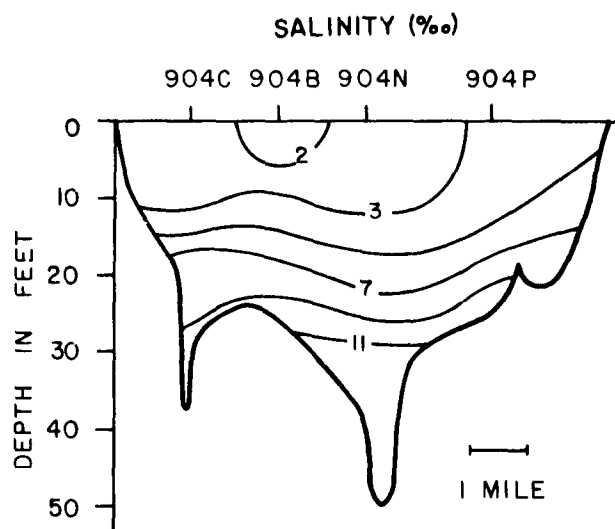
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION IV



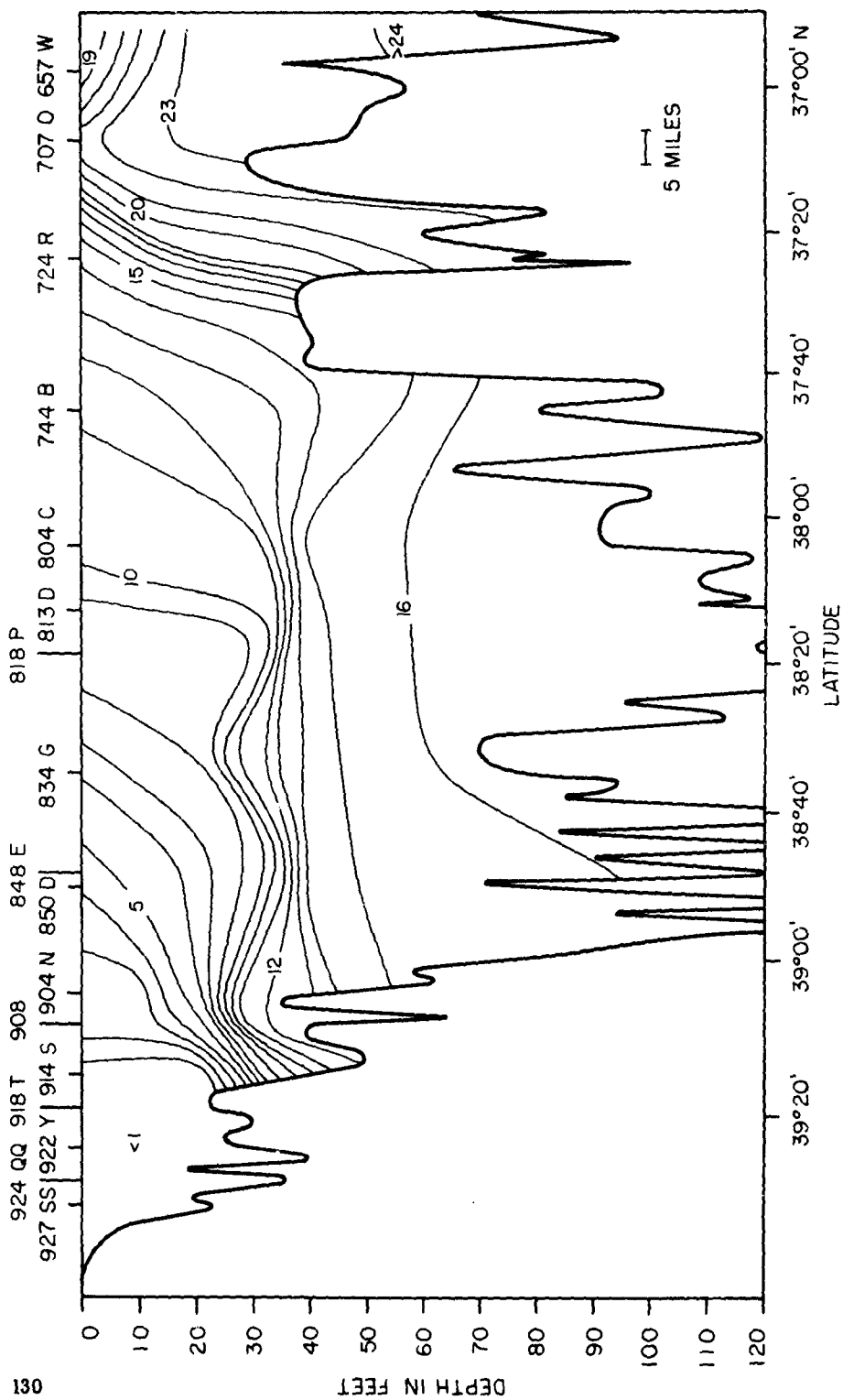
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION VI



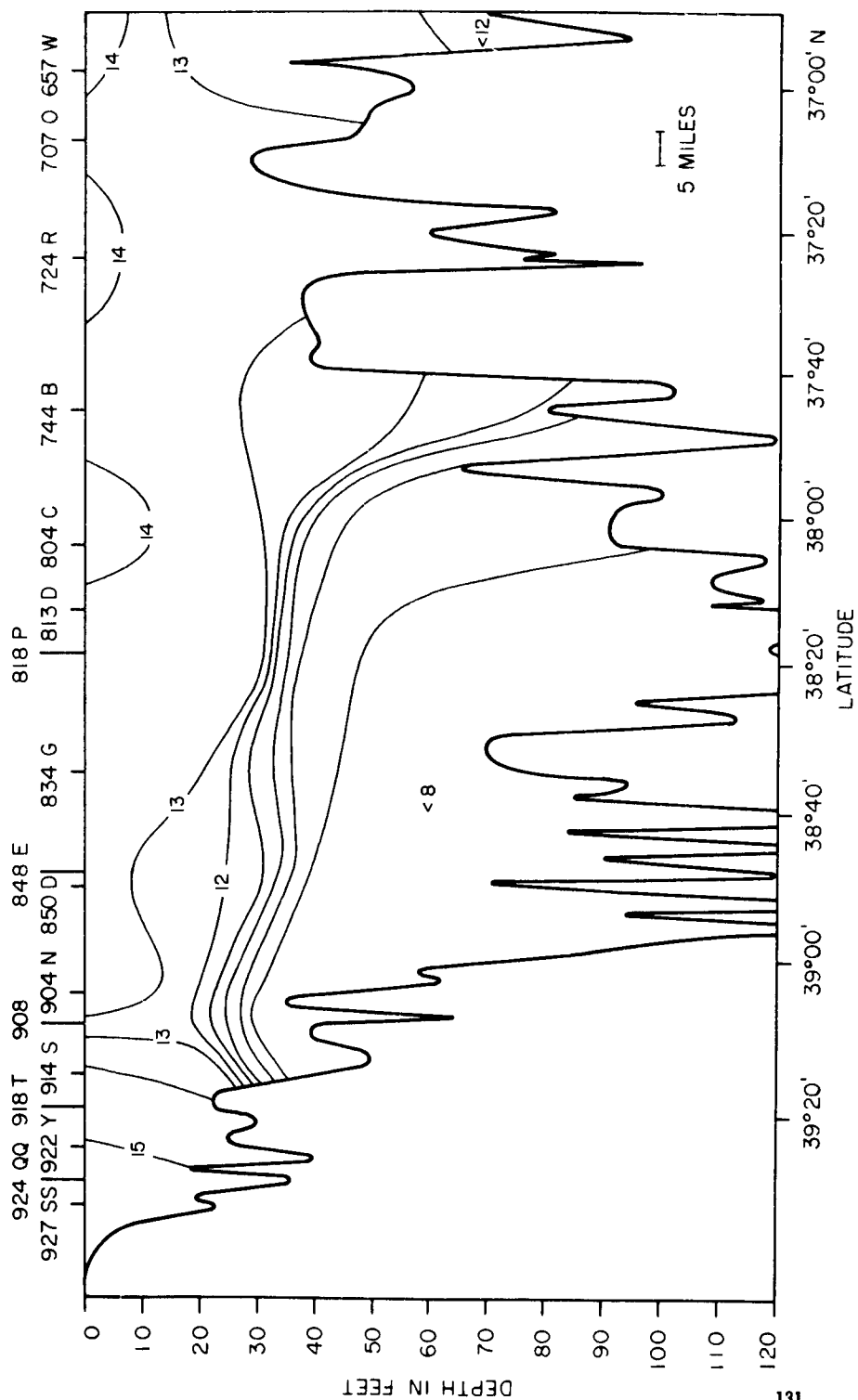
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION X



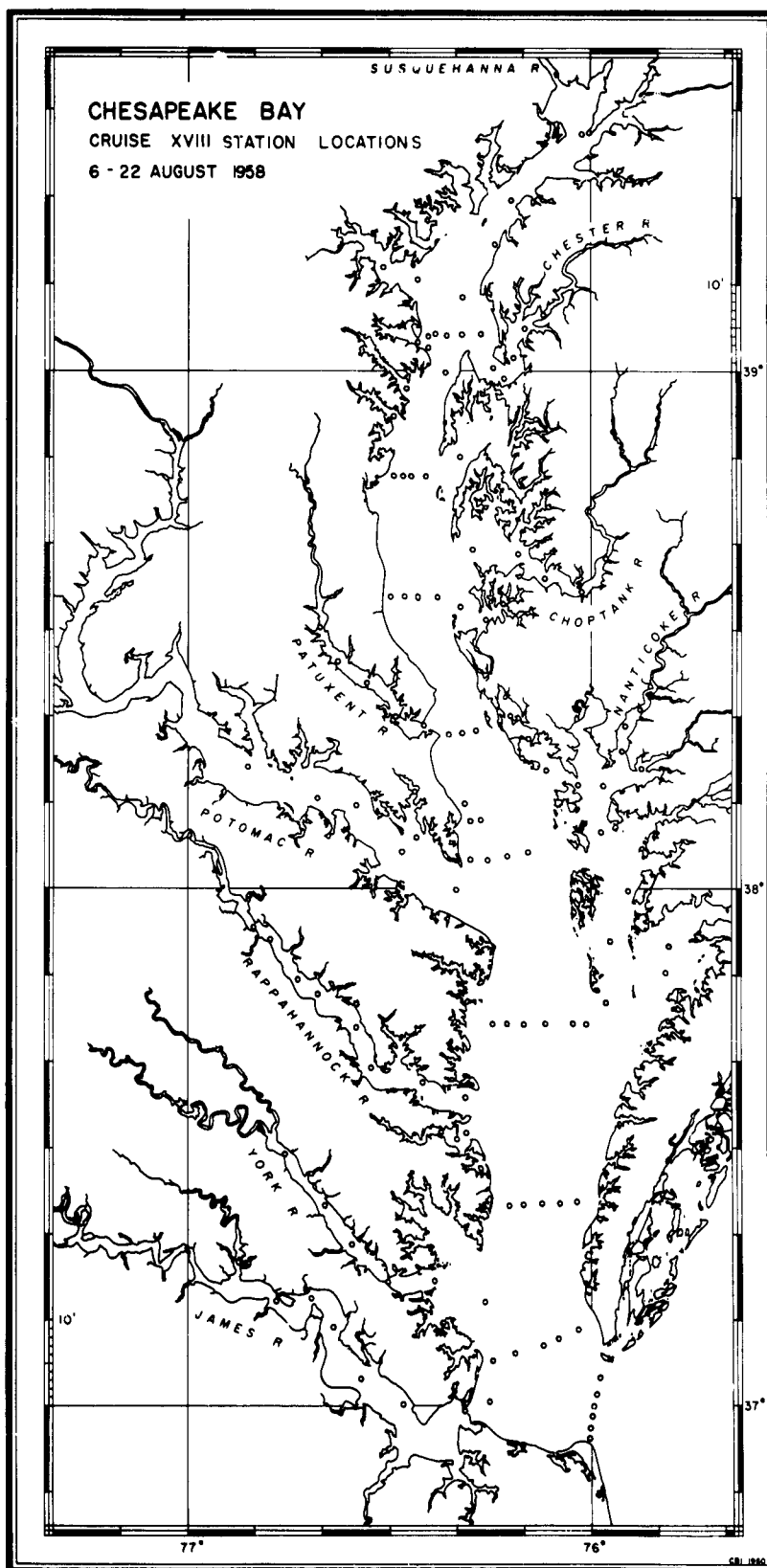
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION XIX
SALINITY (‰)

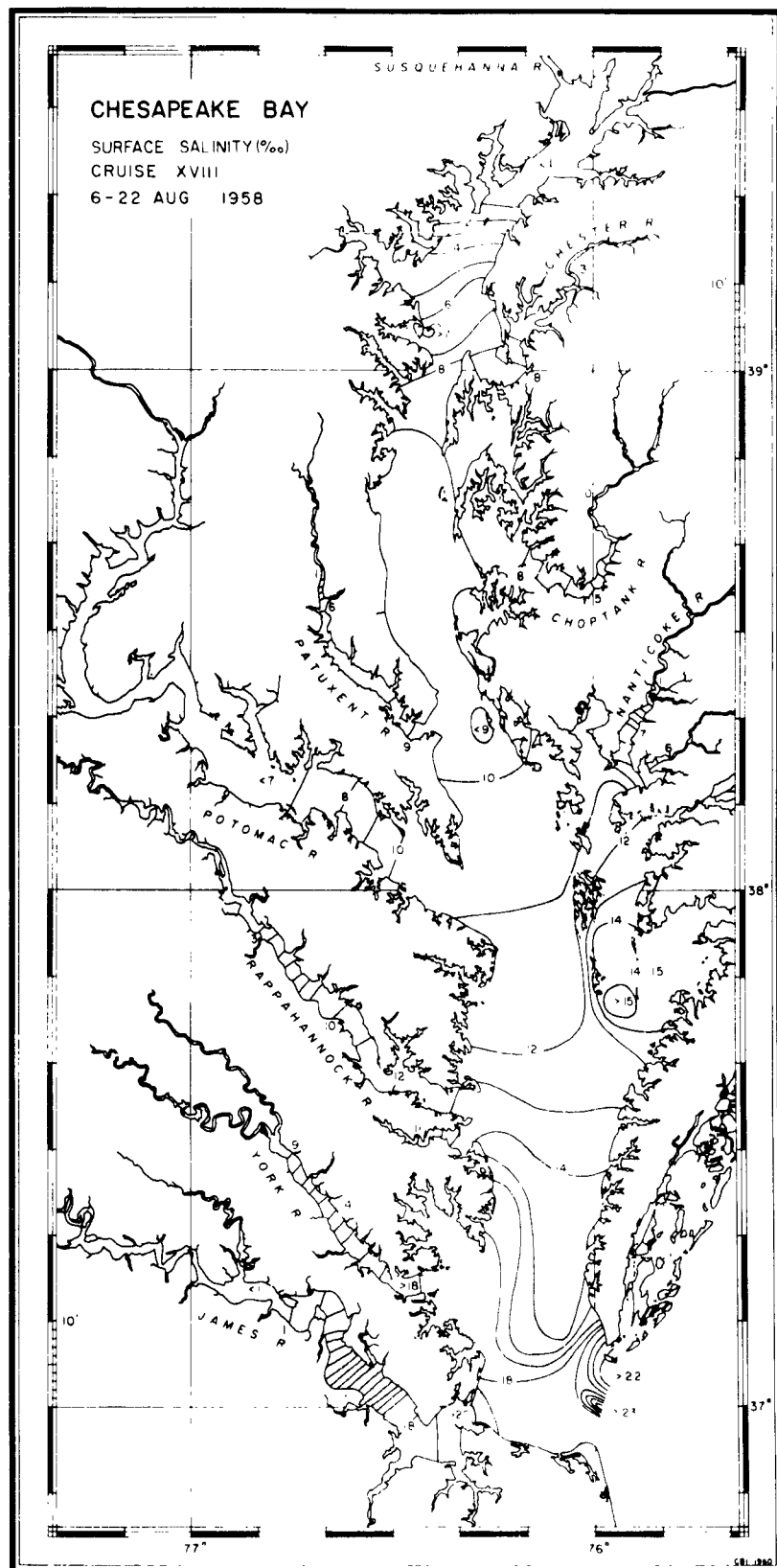


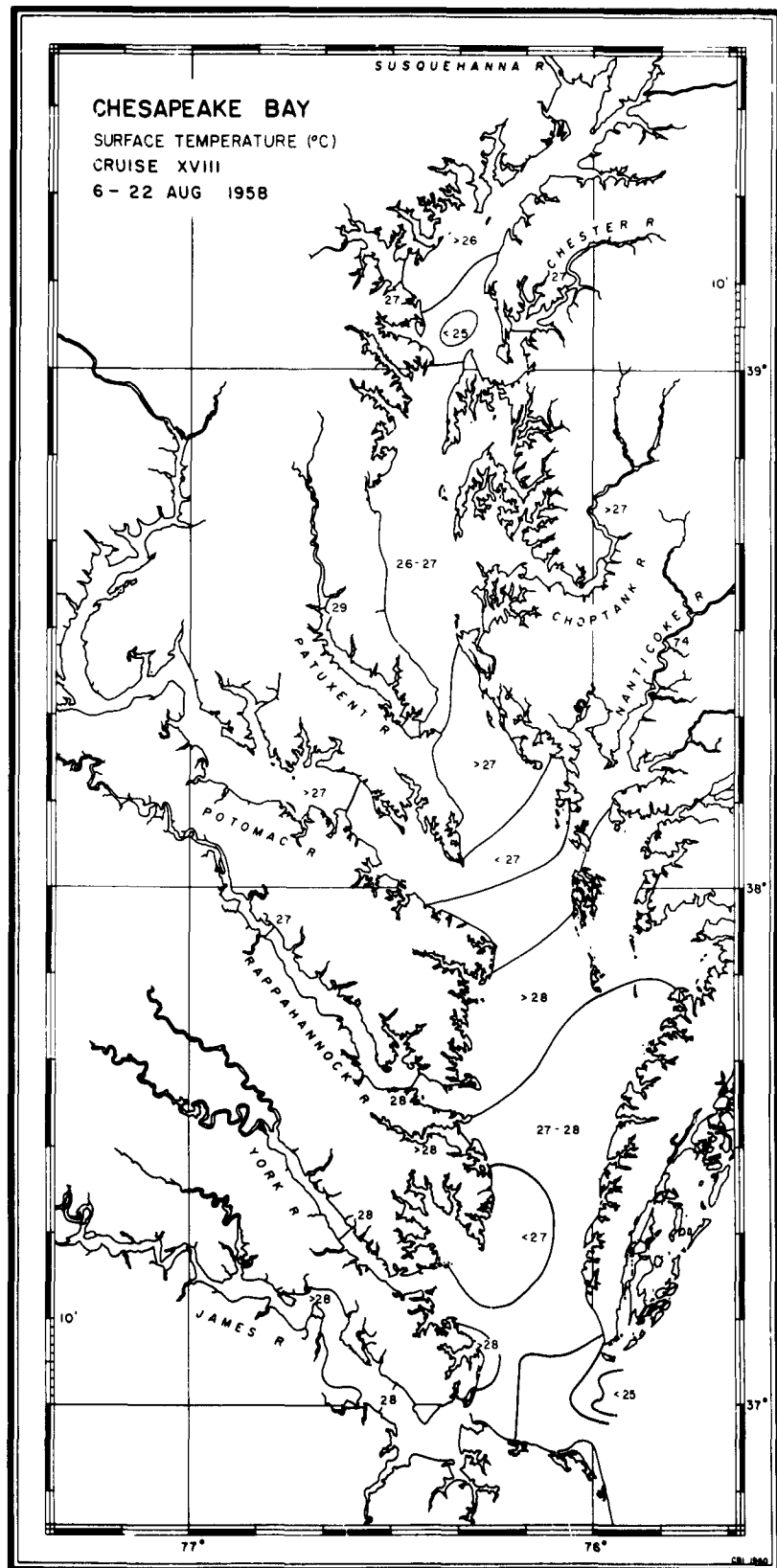
CRUISE XVII 22 APRIL - 13 MAY 1958 SECTION XIX
TEMPERATURE (°C)

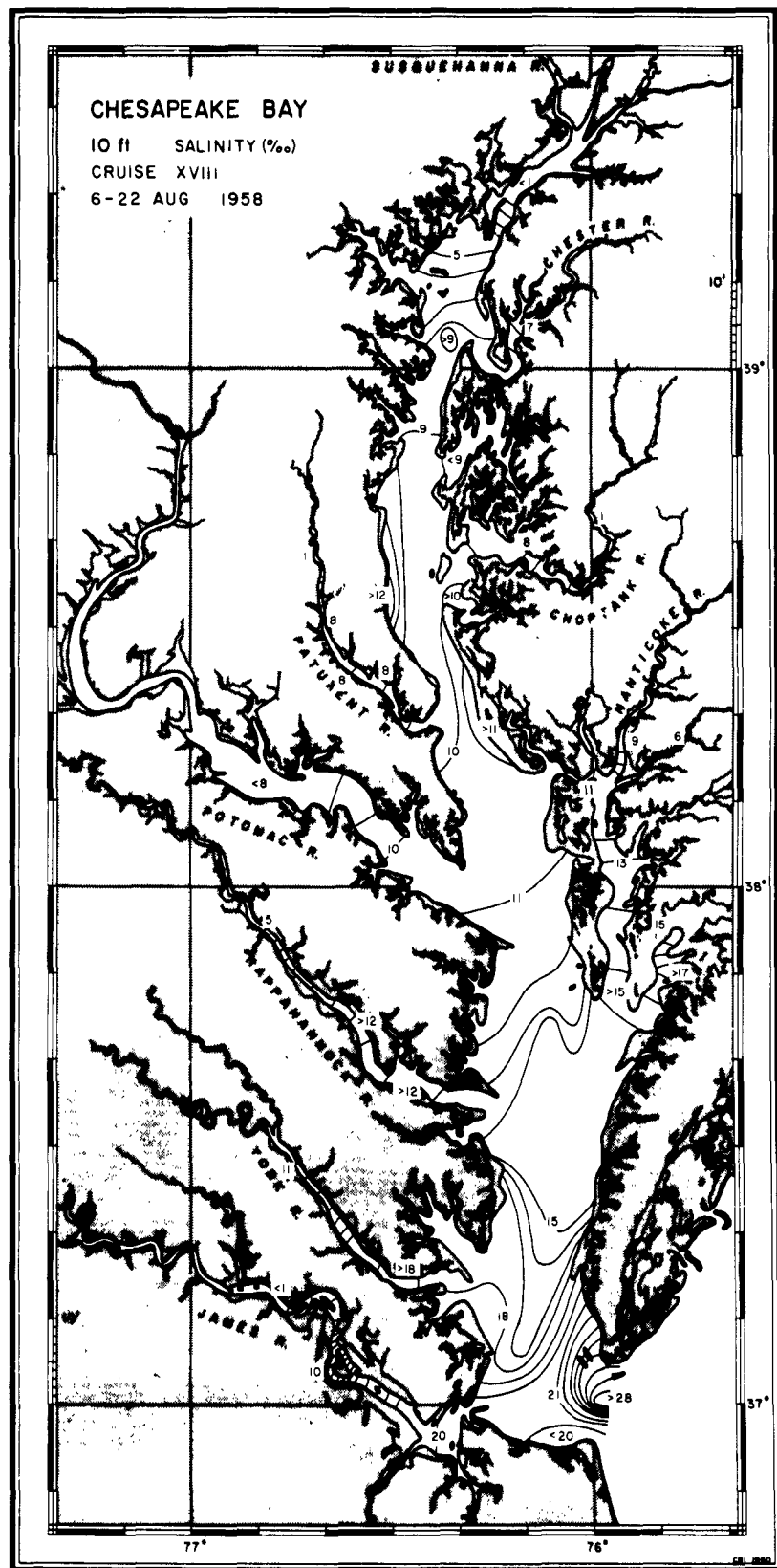


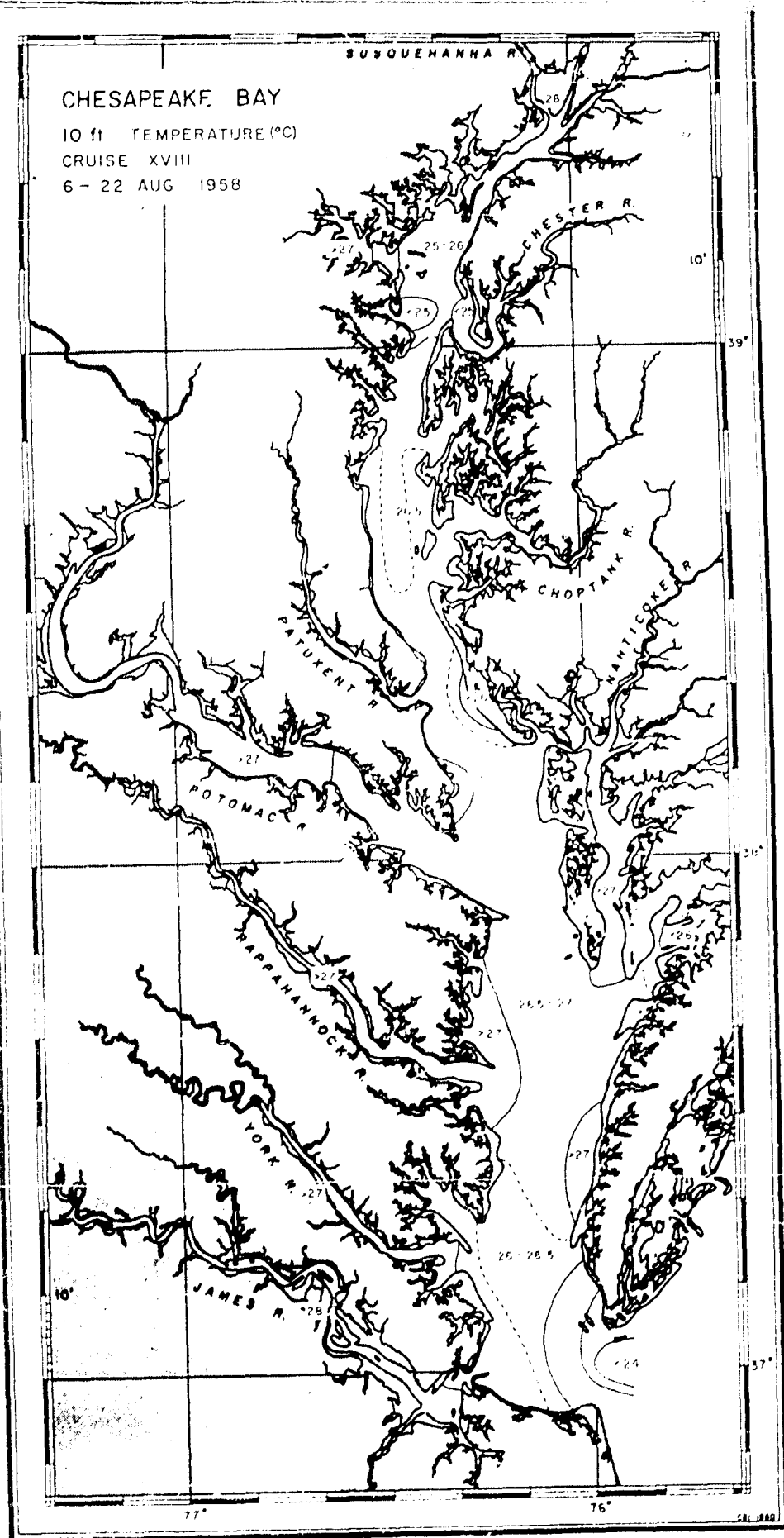
6 - 22 AUGUST 1958

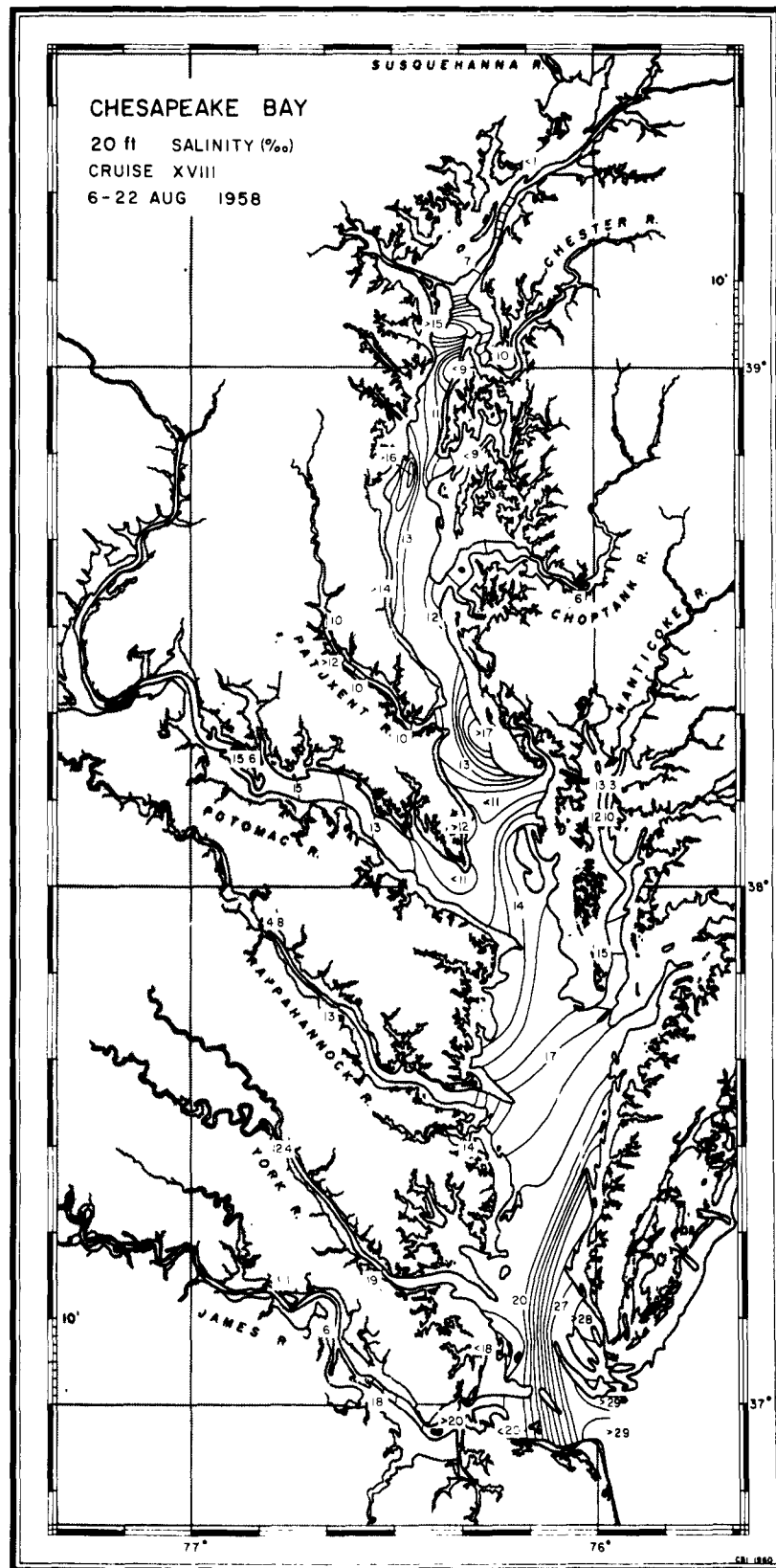










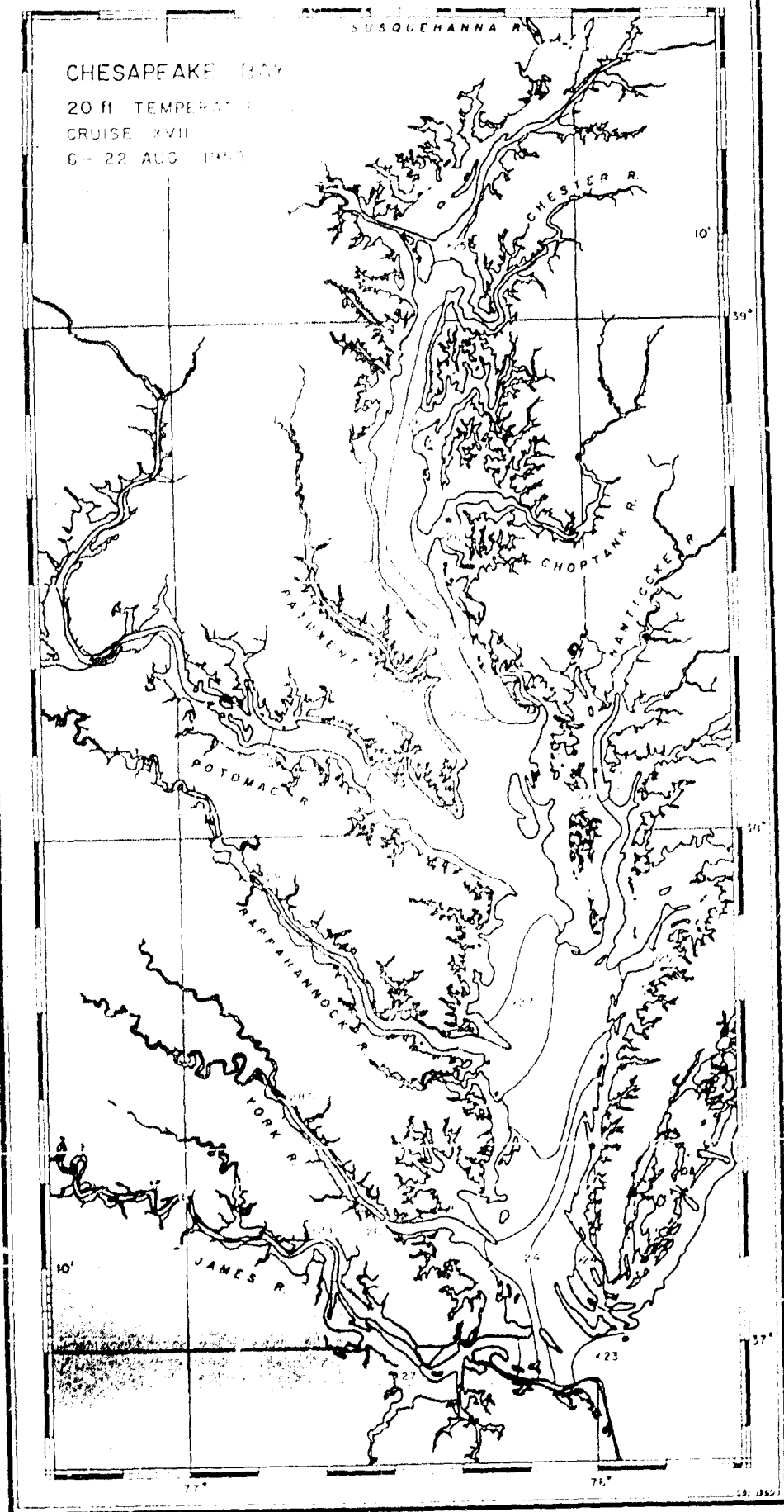


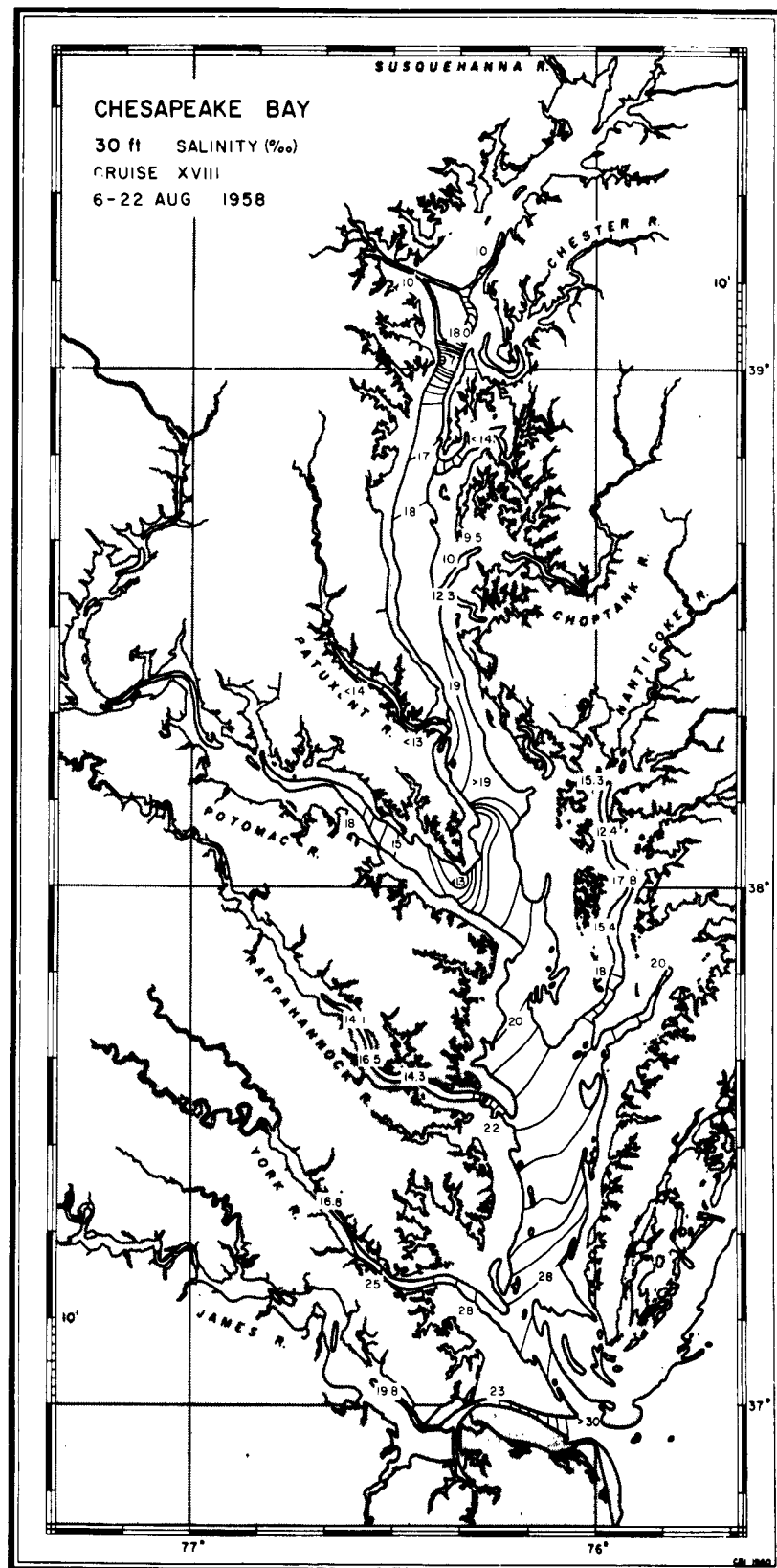
CHESAPEAKE BAY

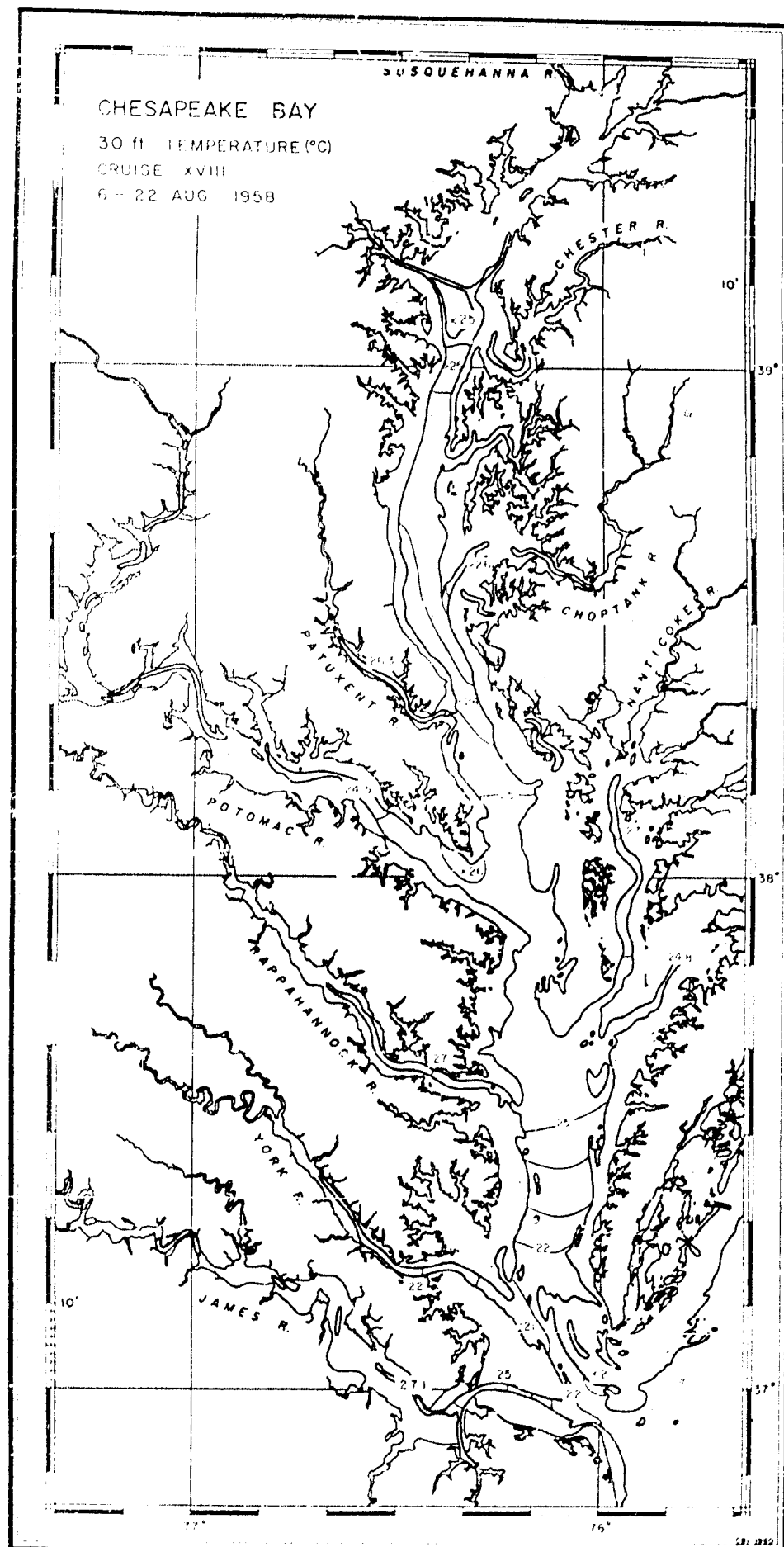
20 ft TEMPERATURE

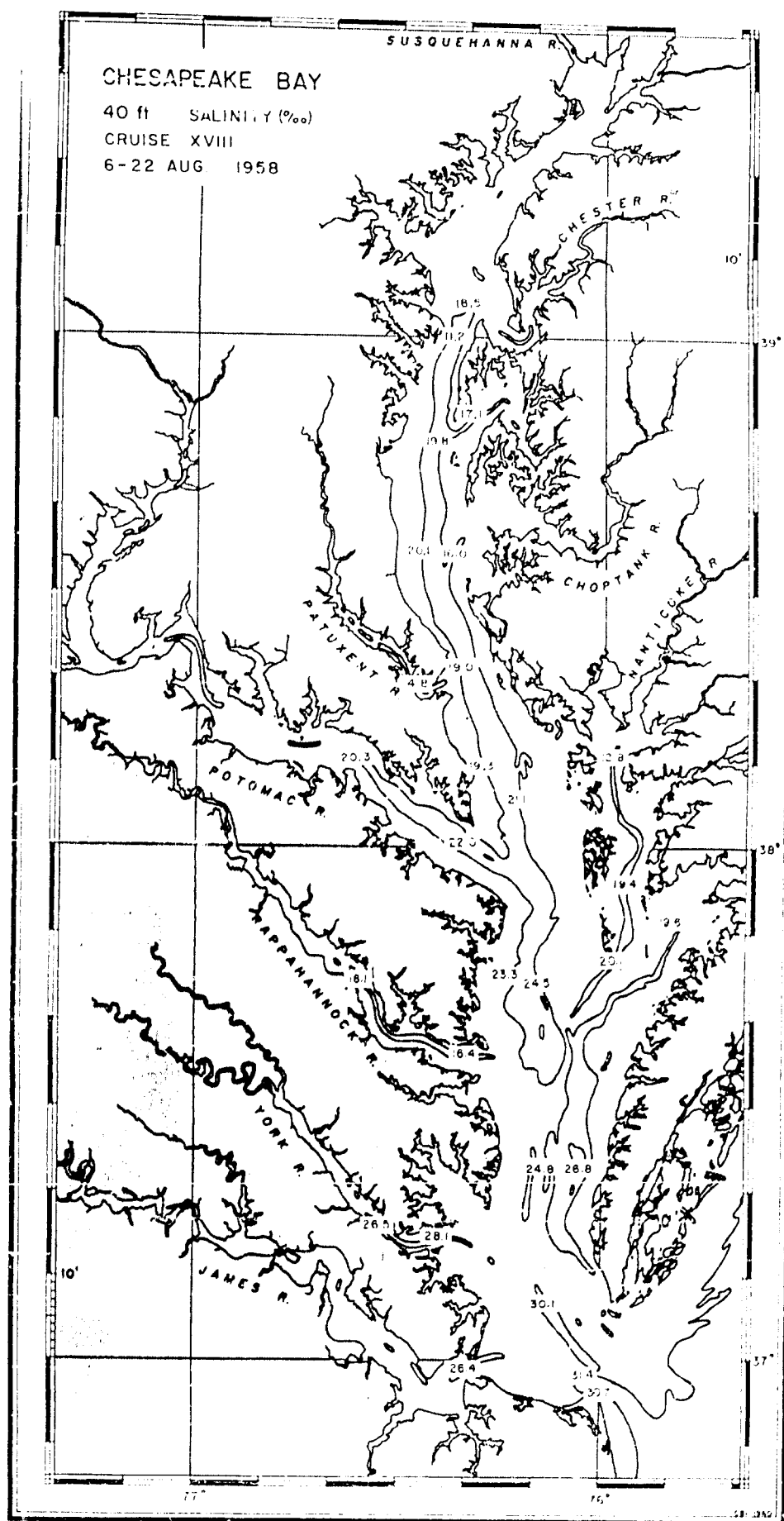
CRUISE XVII

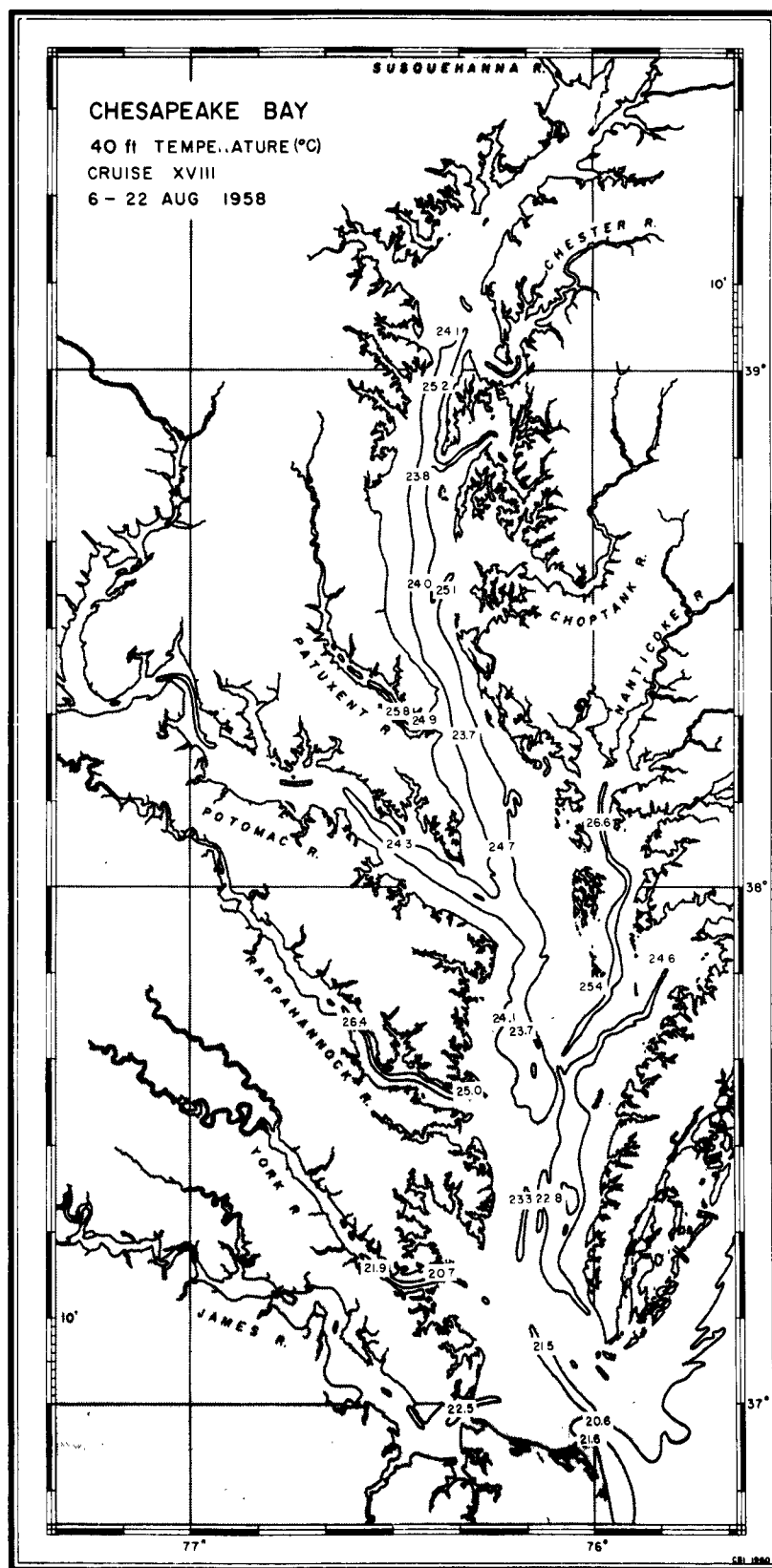
6 - 22 AUG 1969

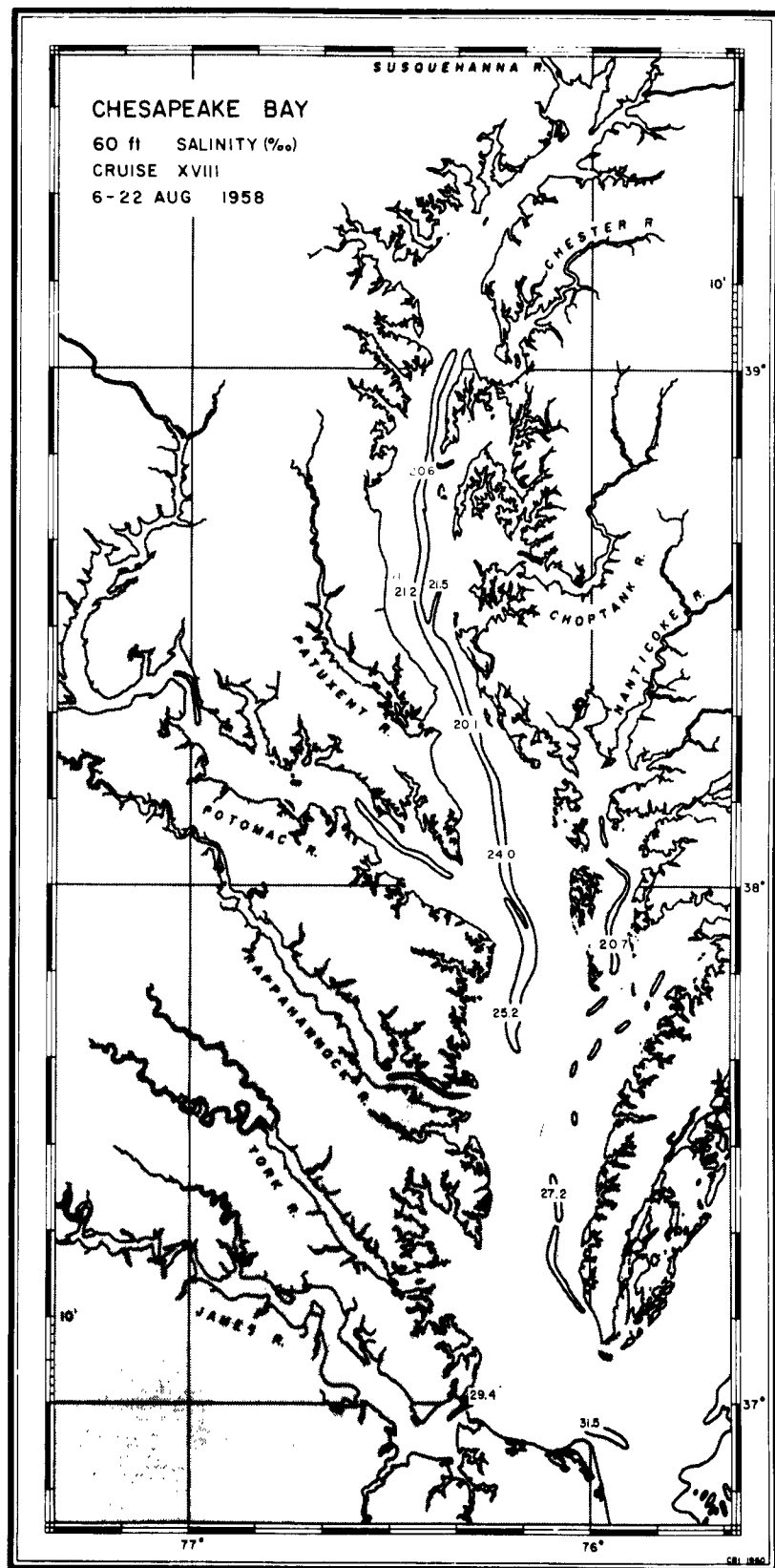


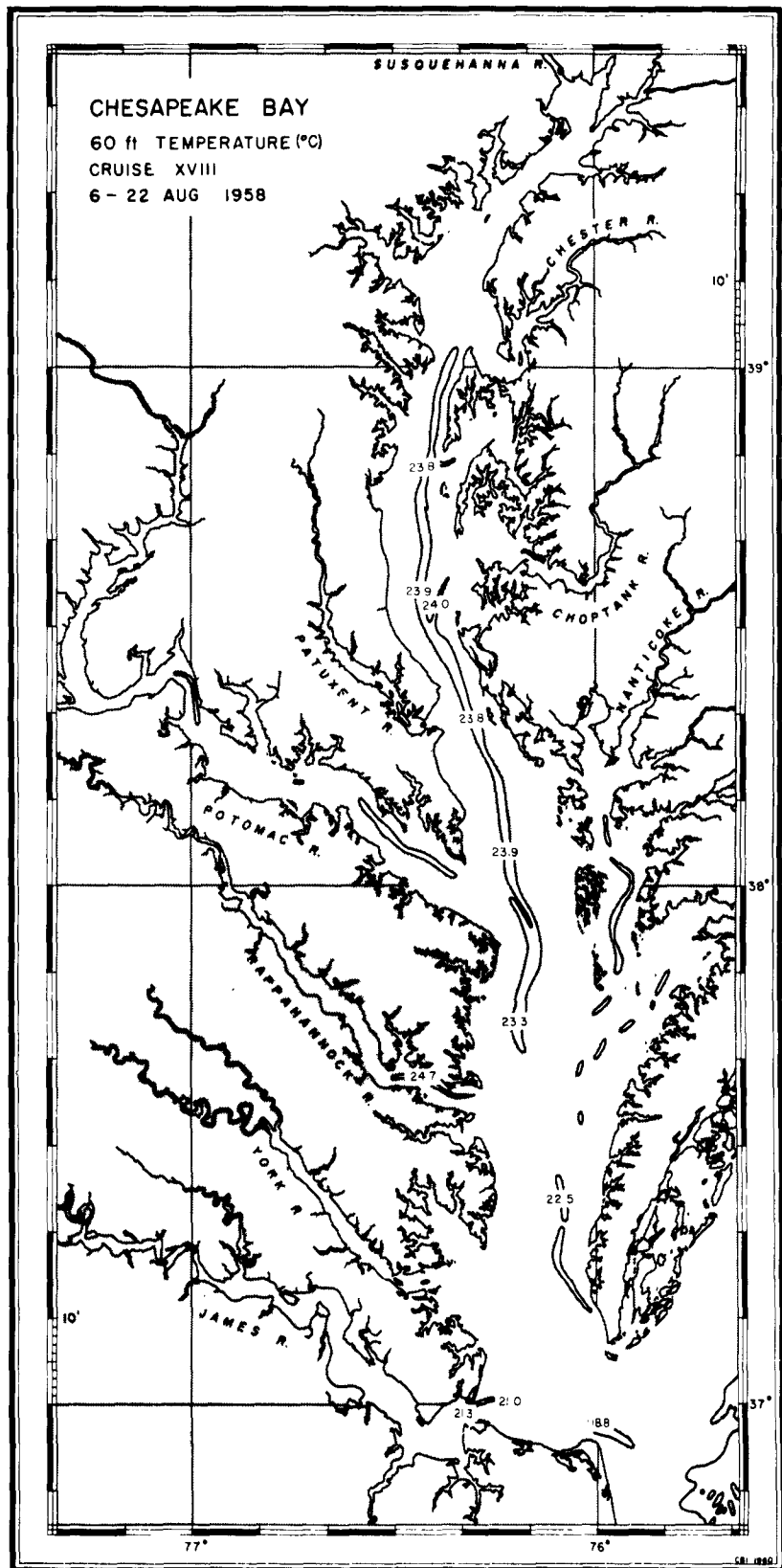




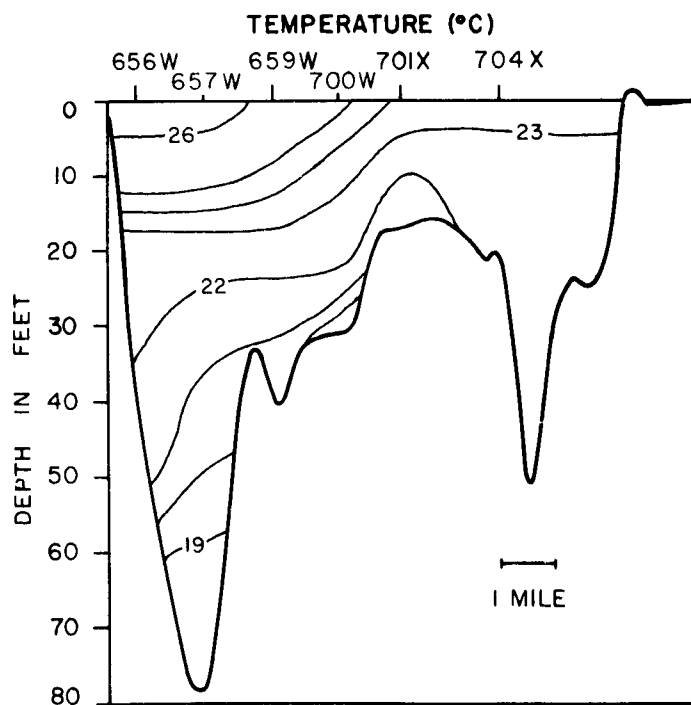
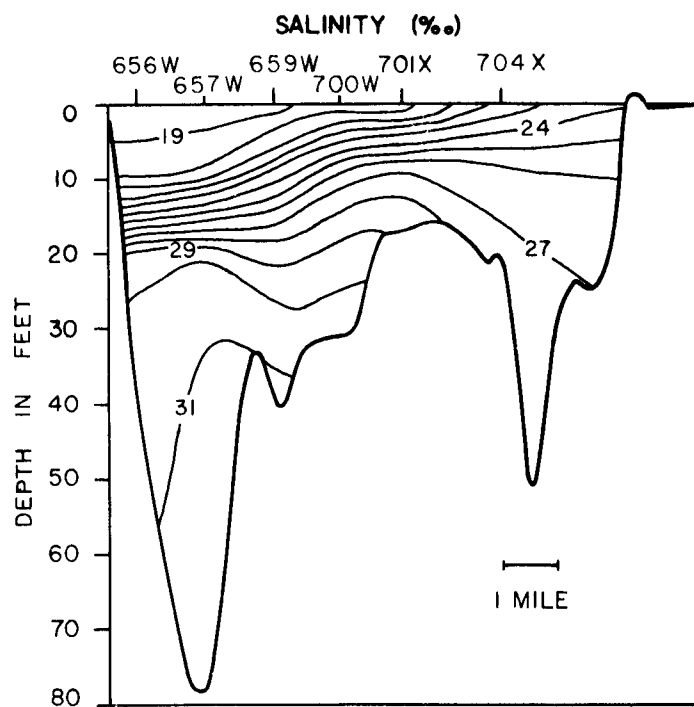




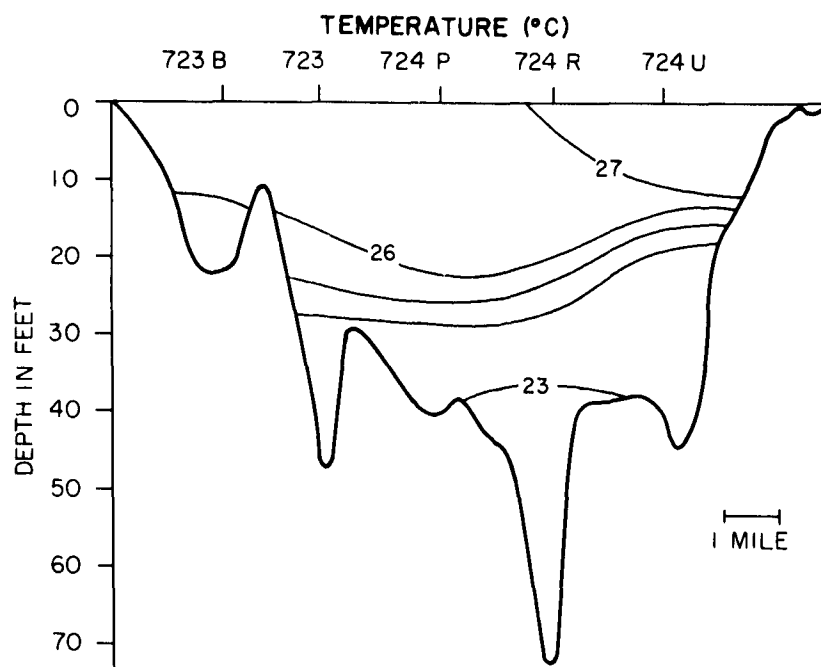
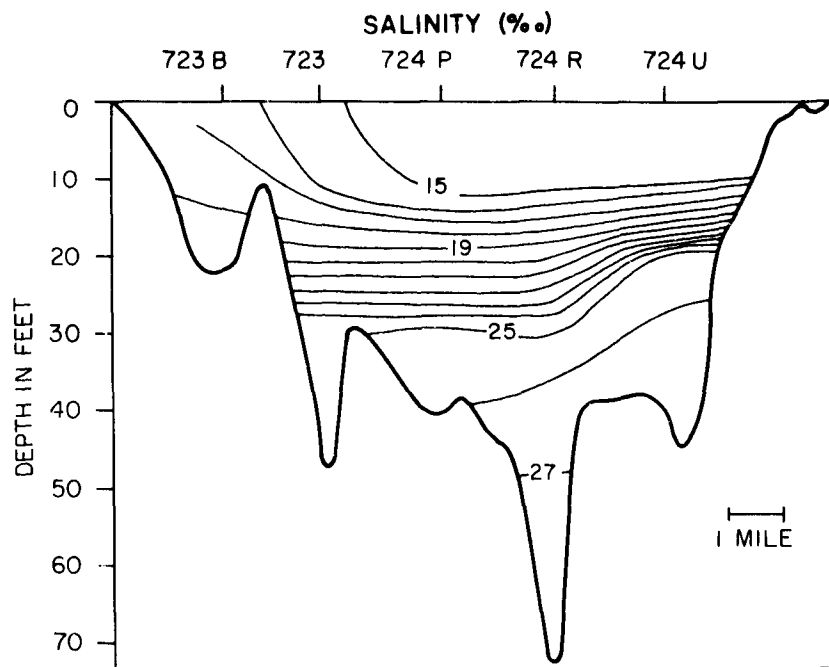




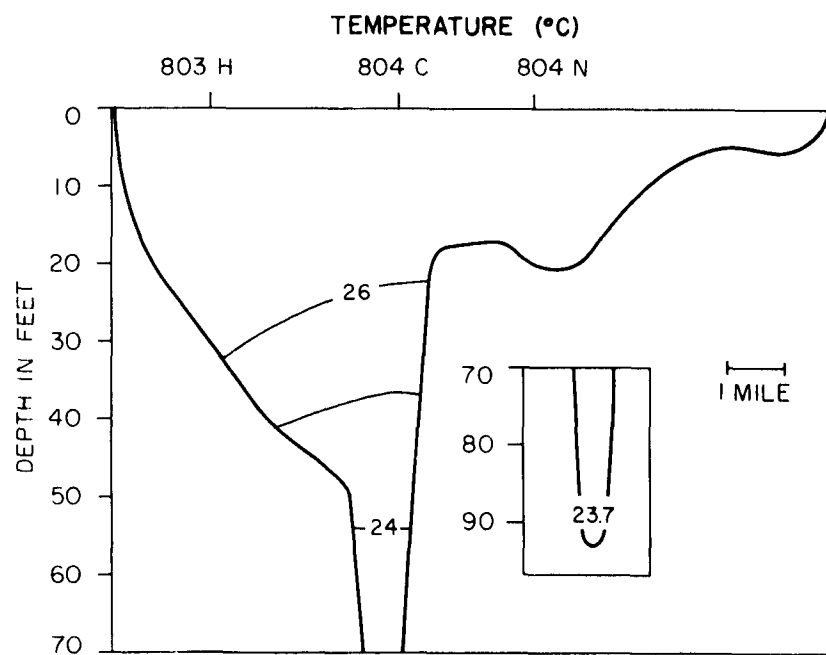
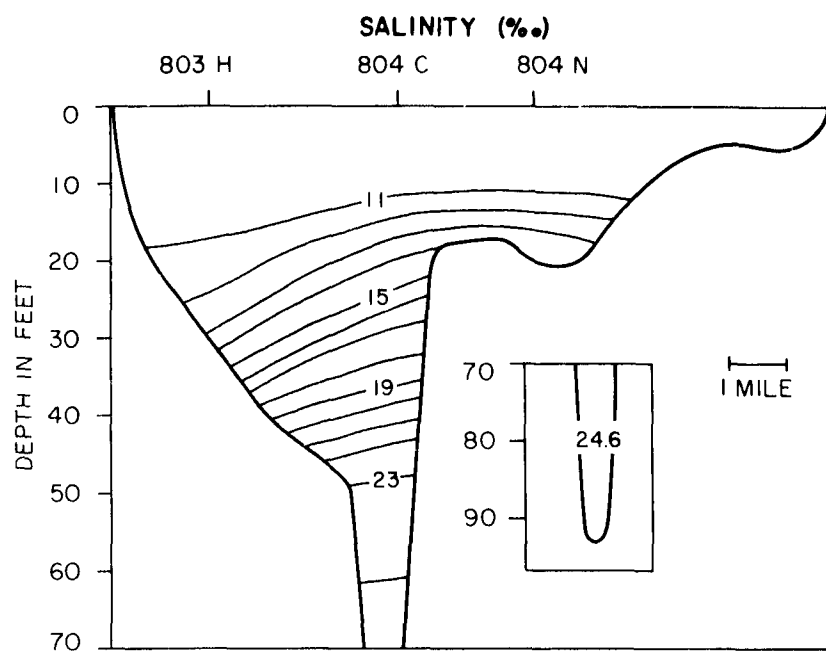
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION II



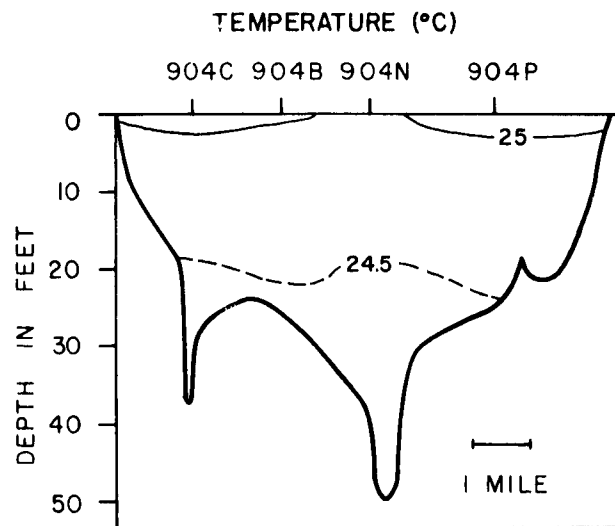
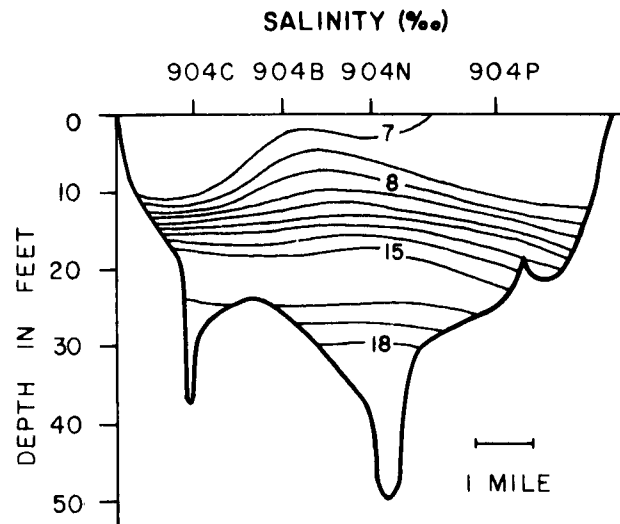
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION IV



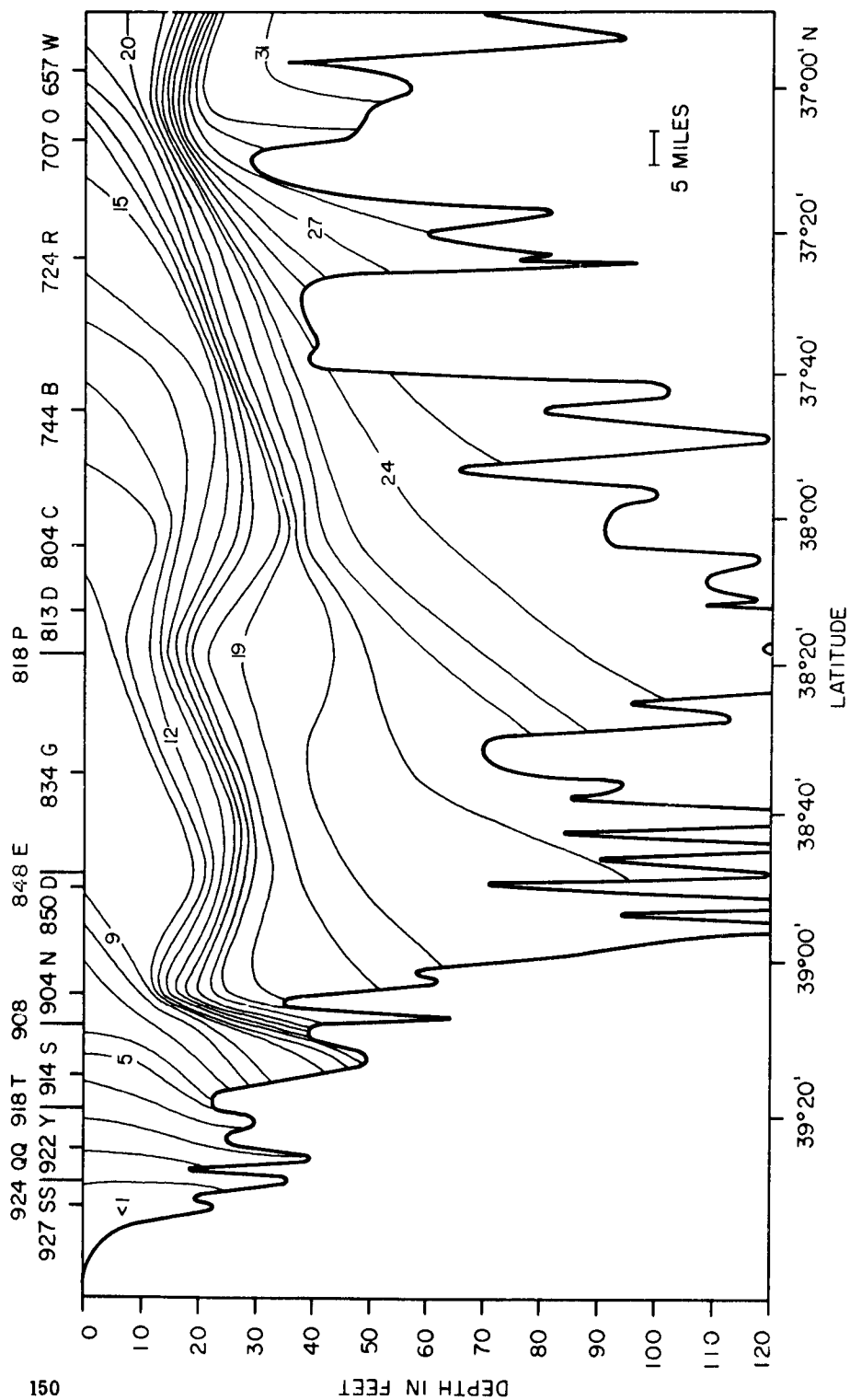
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION VI



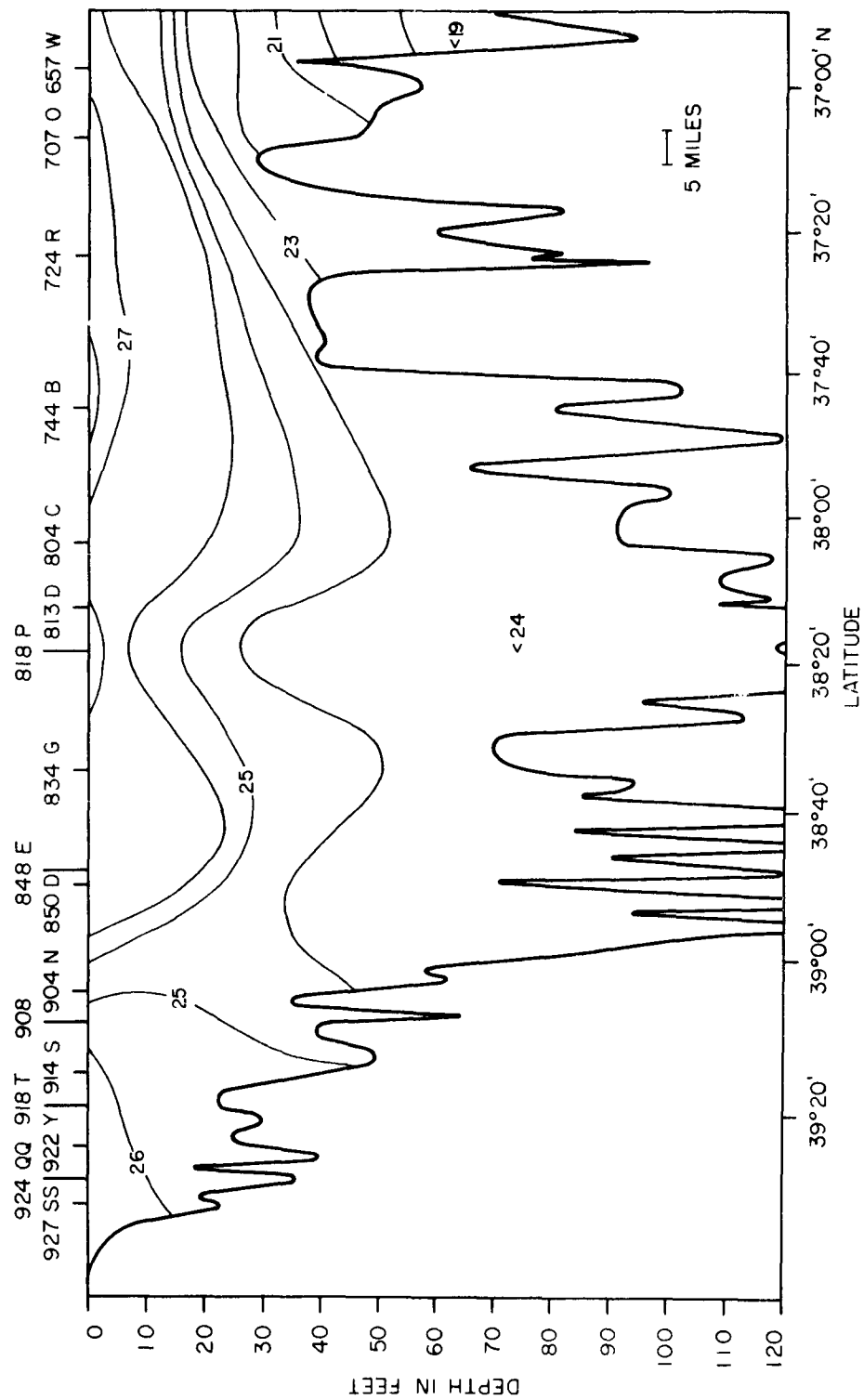
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION X

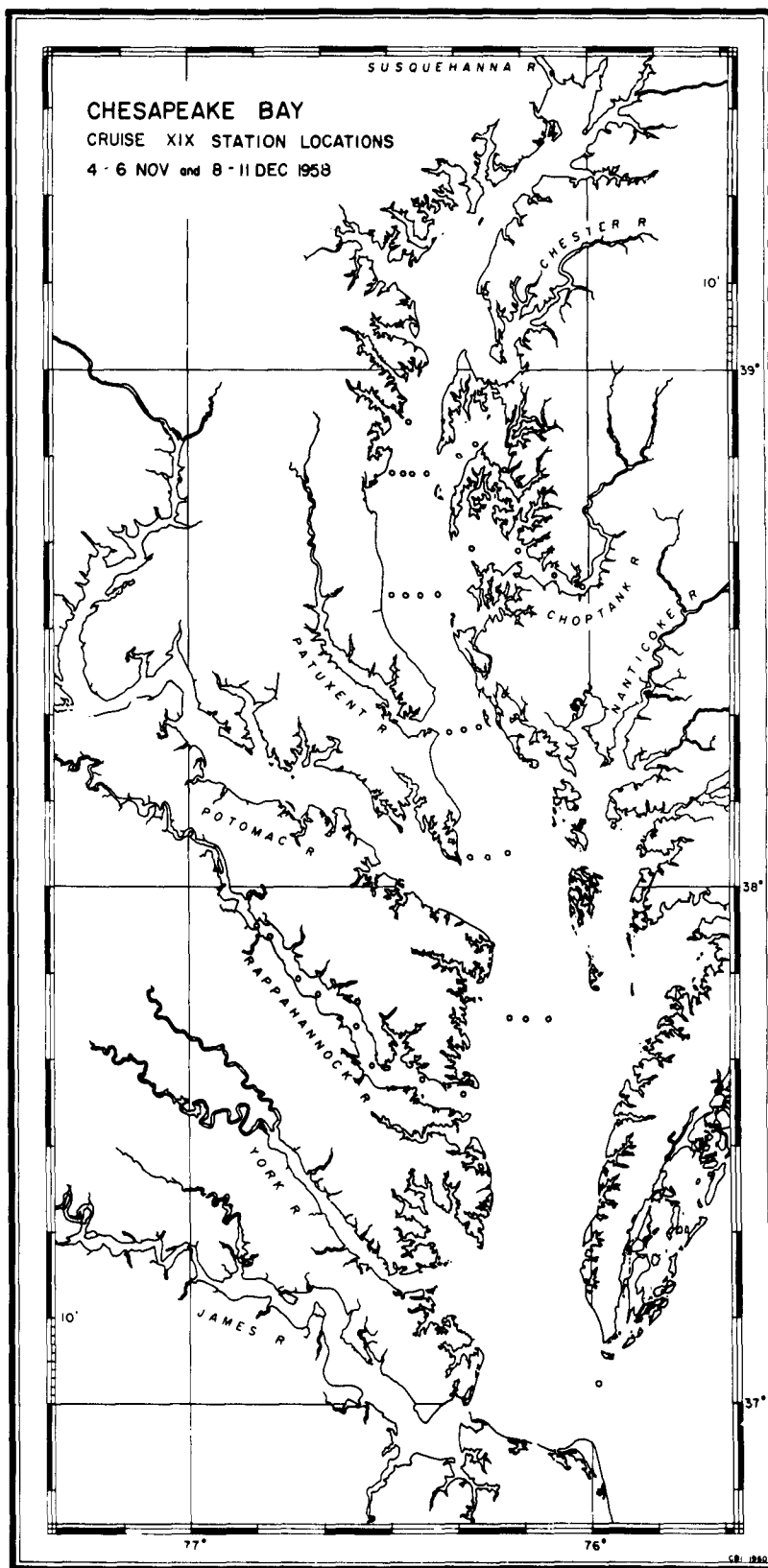


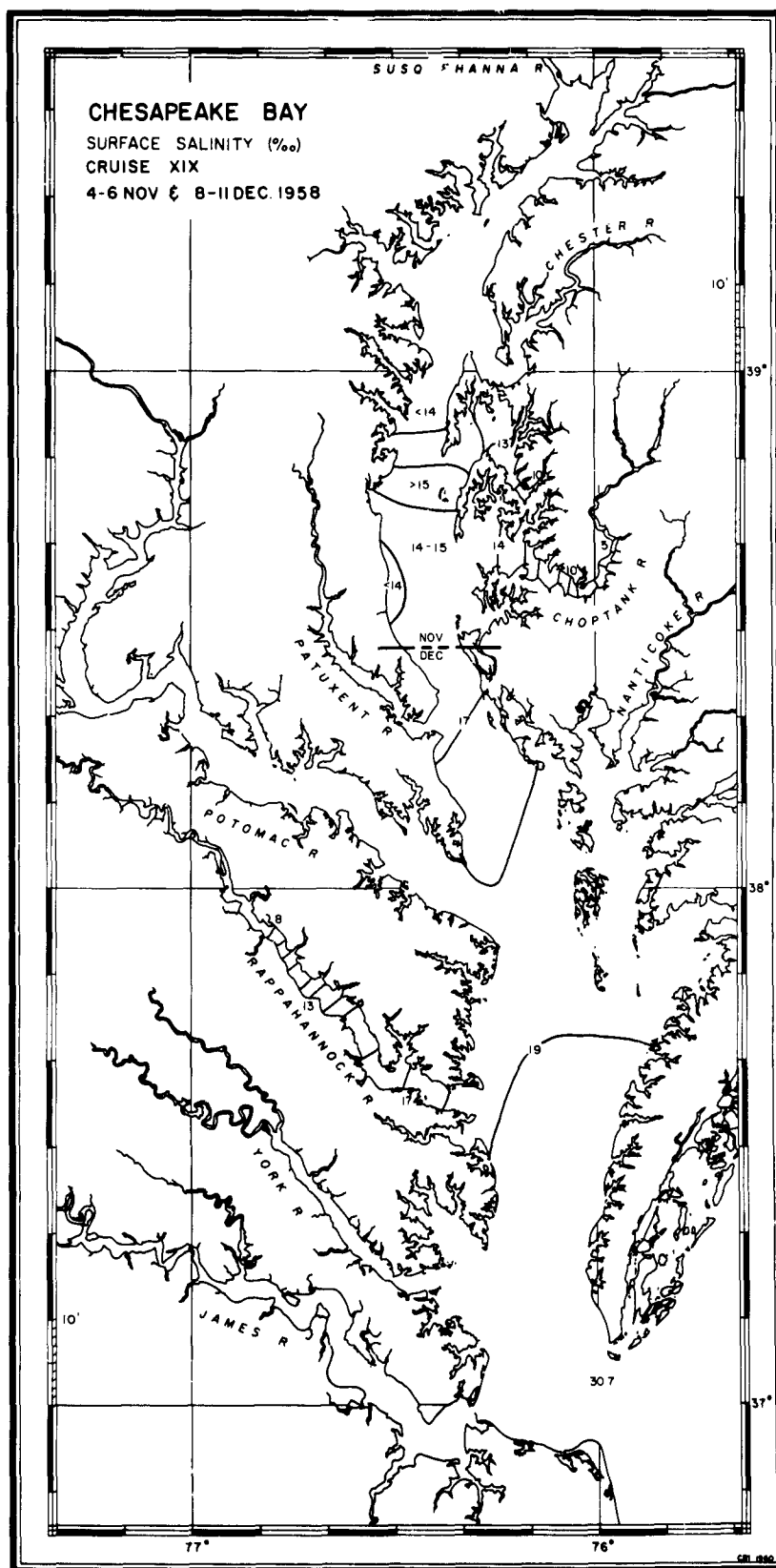
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION XIX
SALINITY (‰)

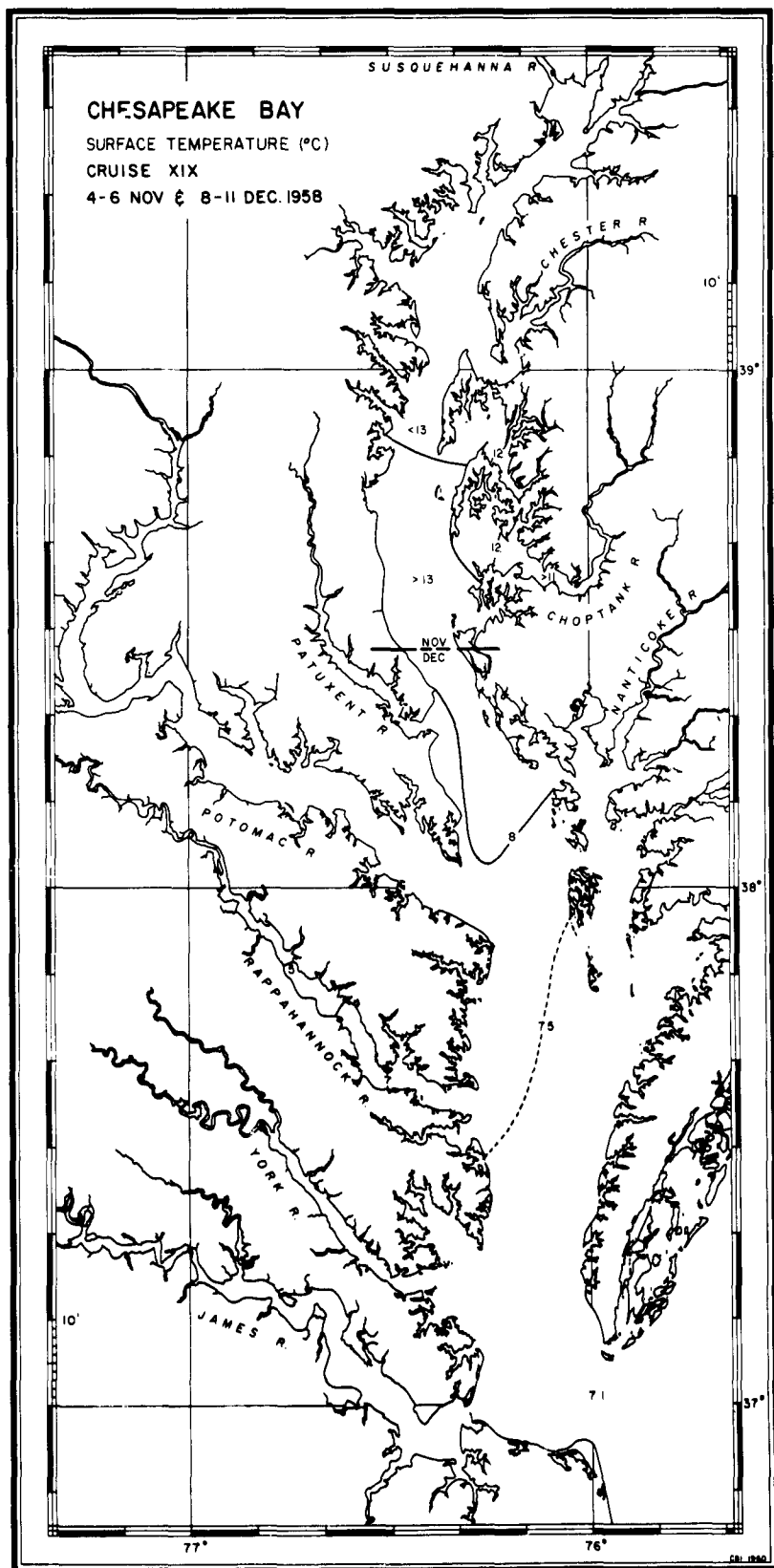


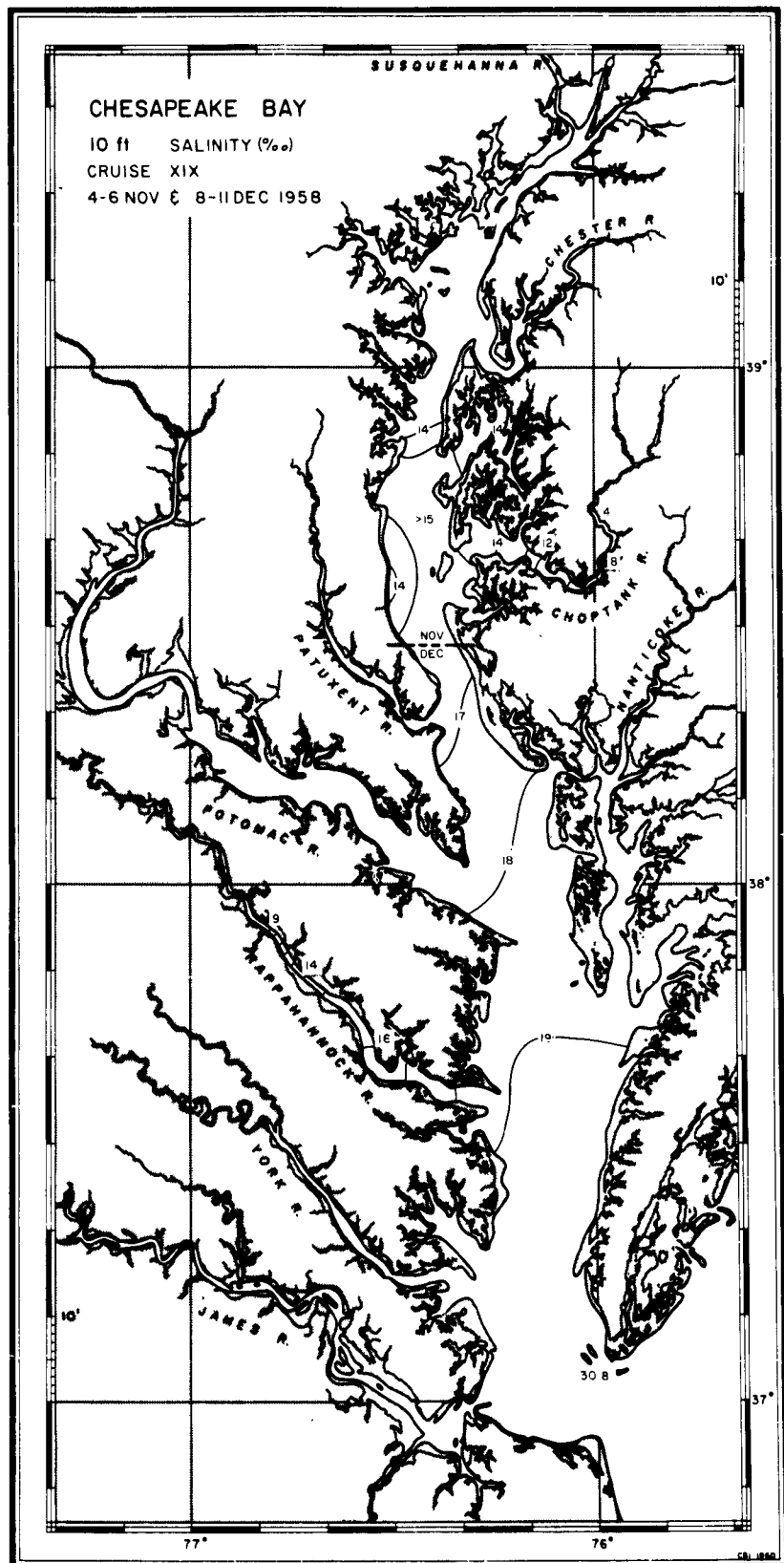
CRUISE XVIII 6 - 22 AUGUST 1958 SECTION XIX
TEMPERATURE (°C)

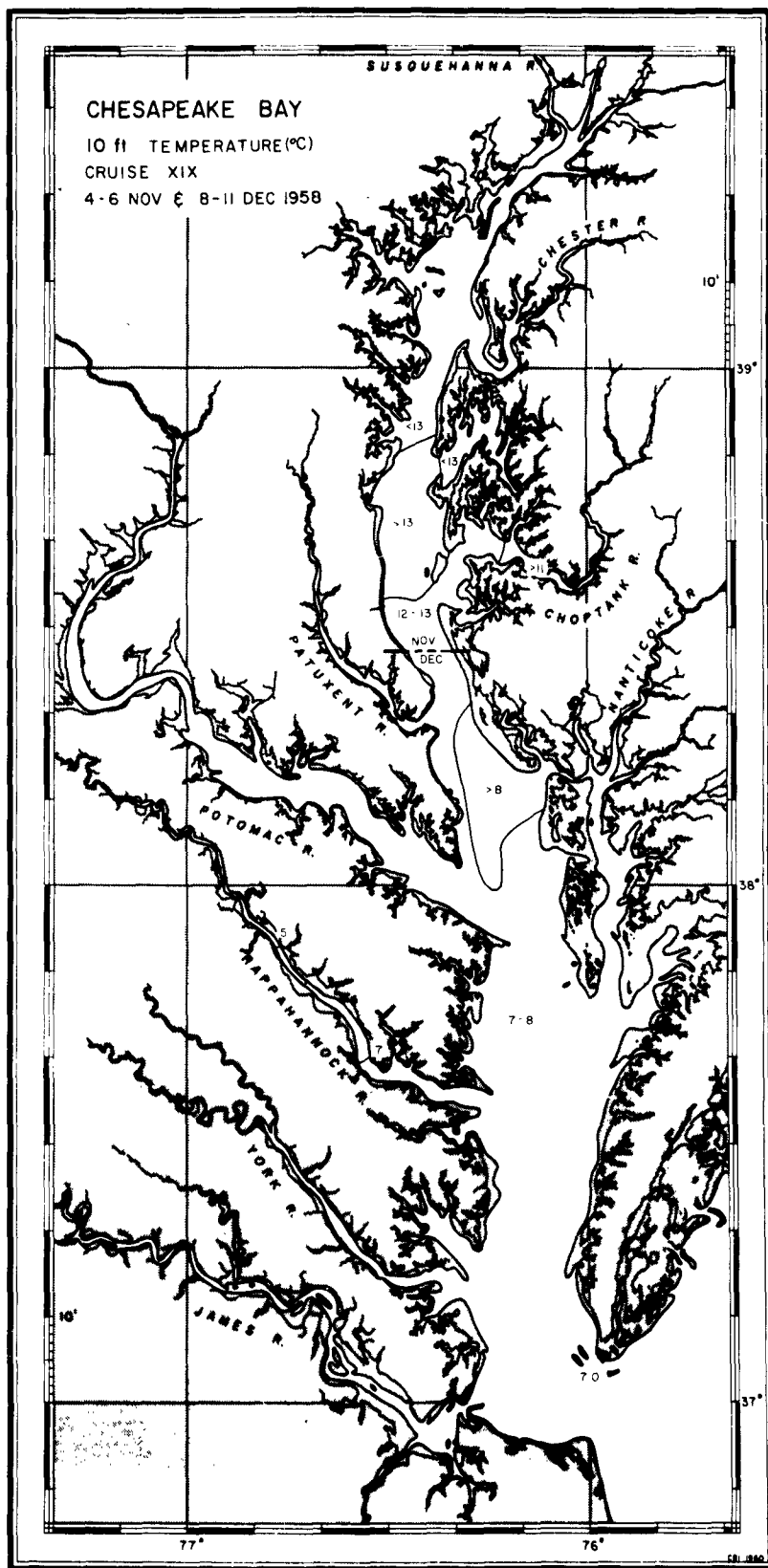


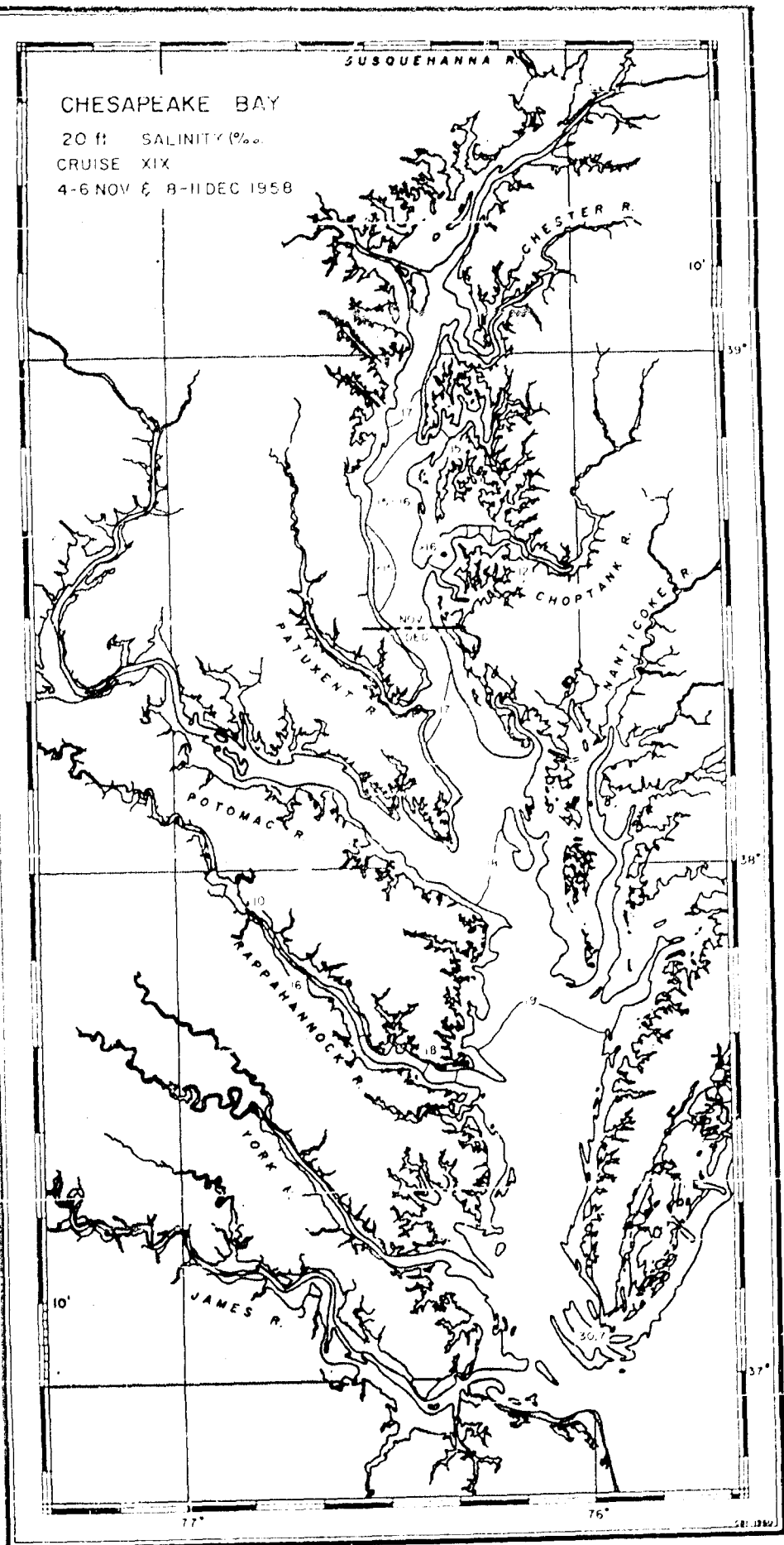


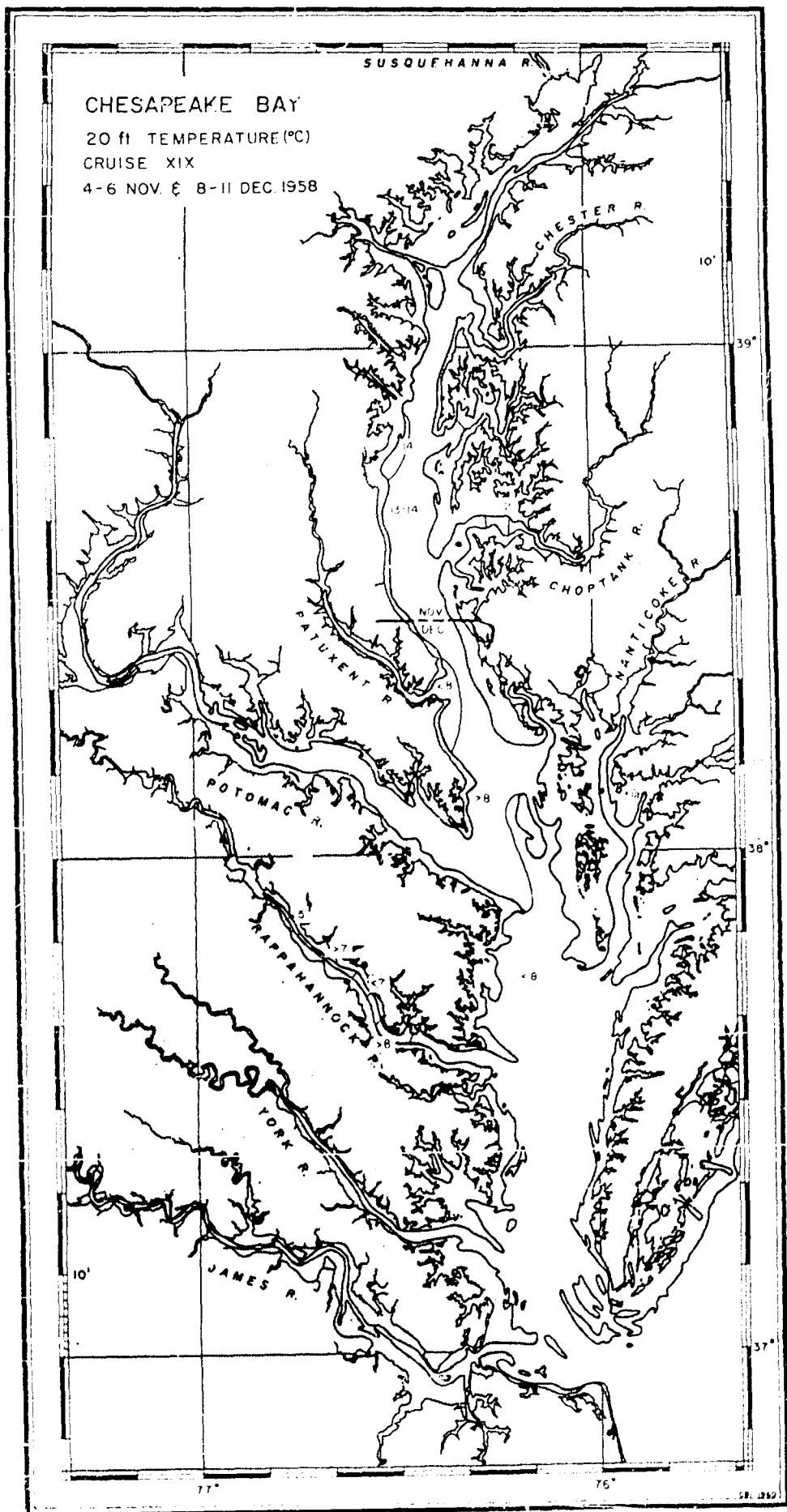


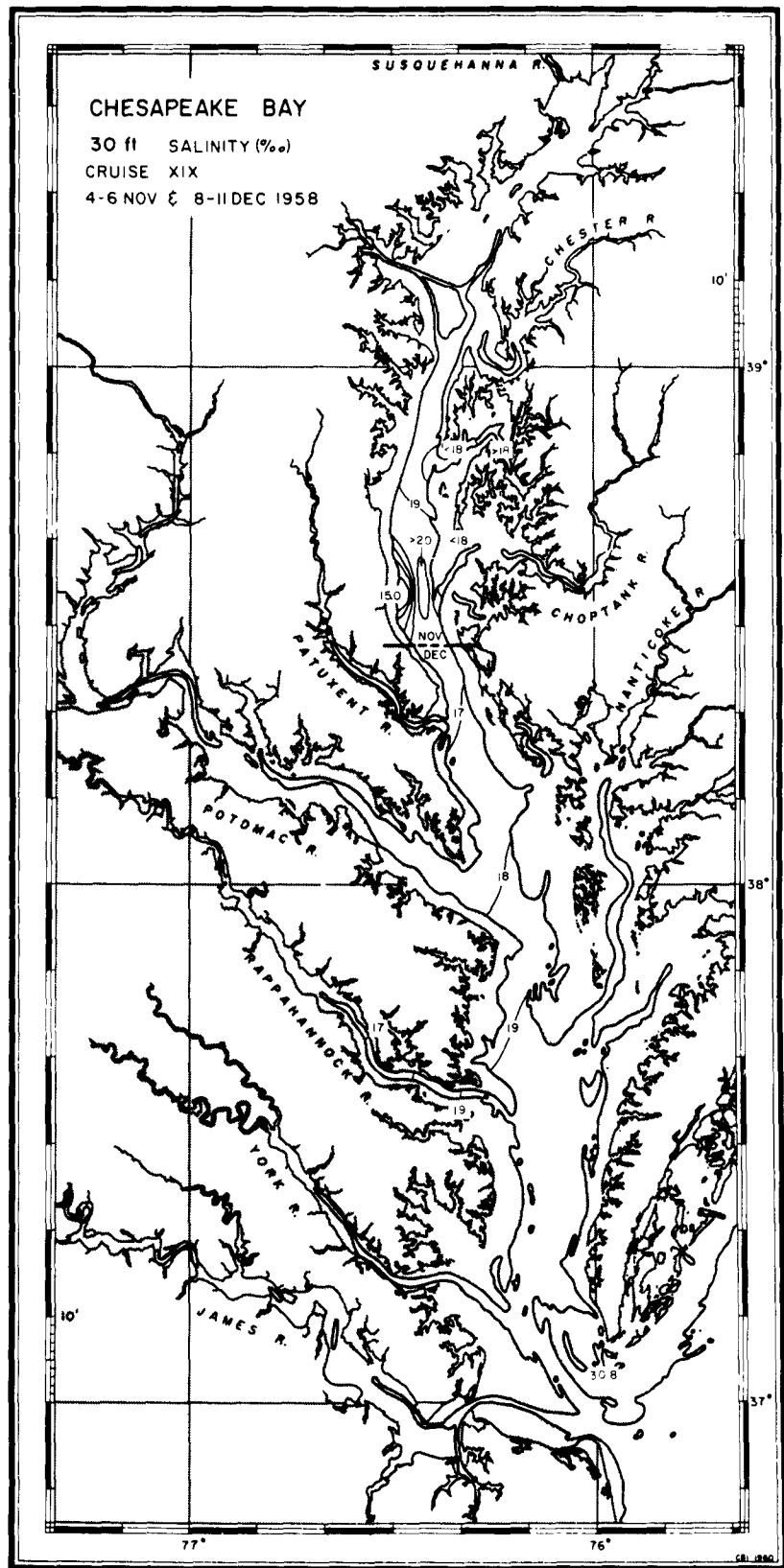


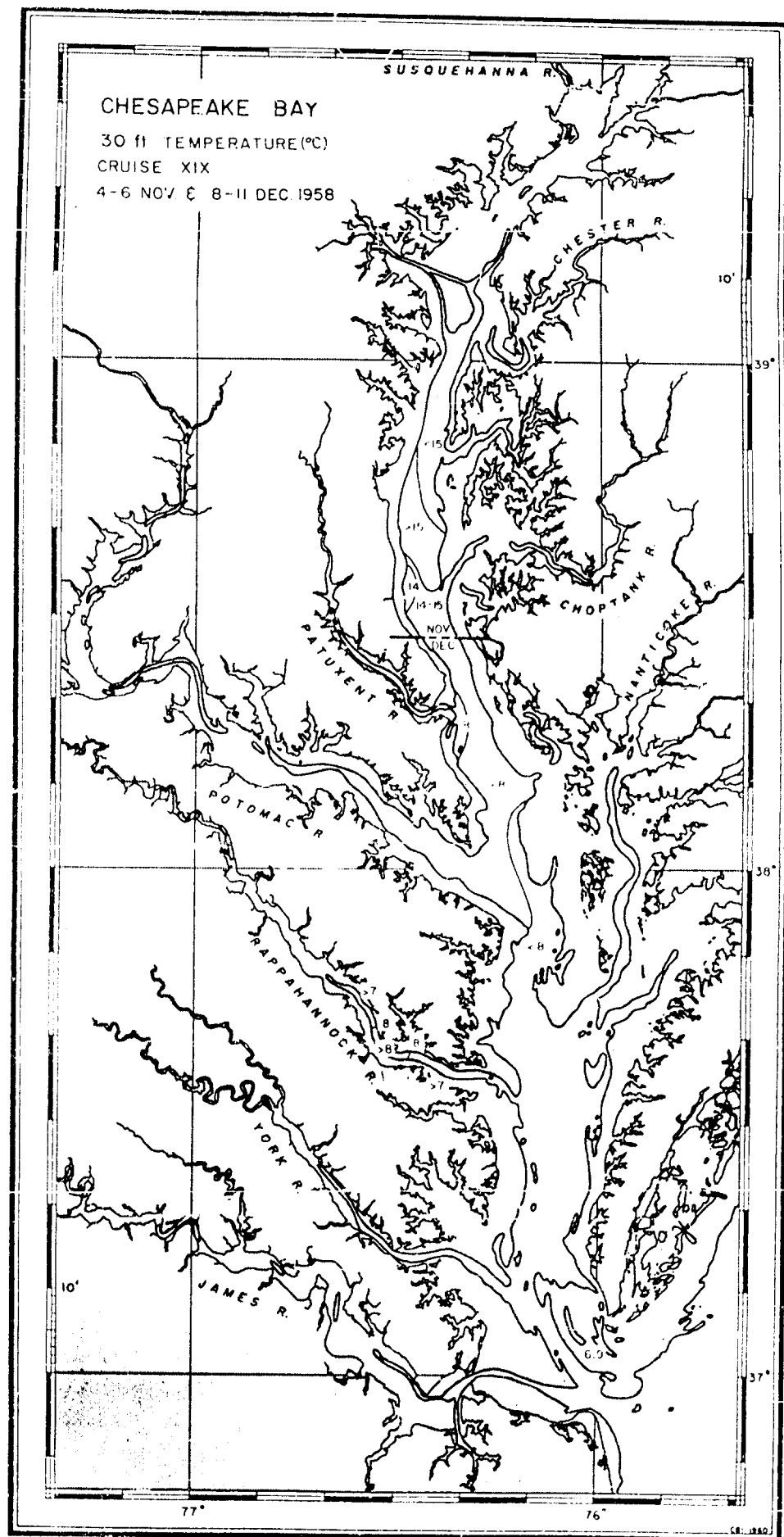


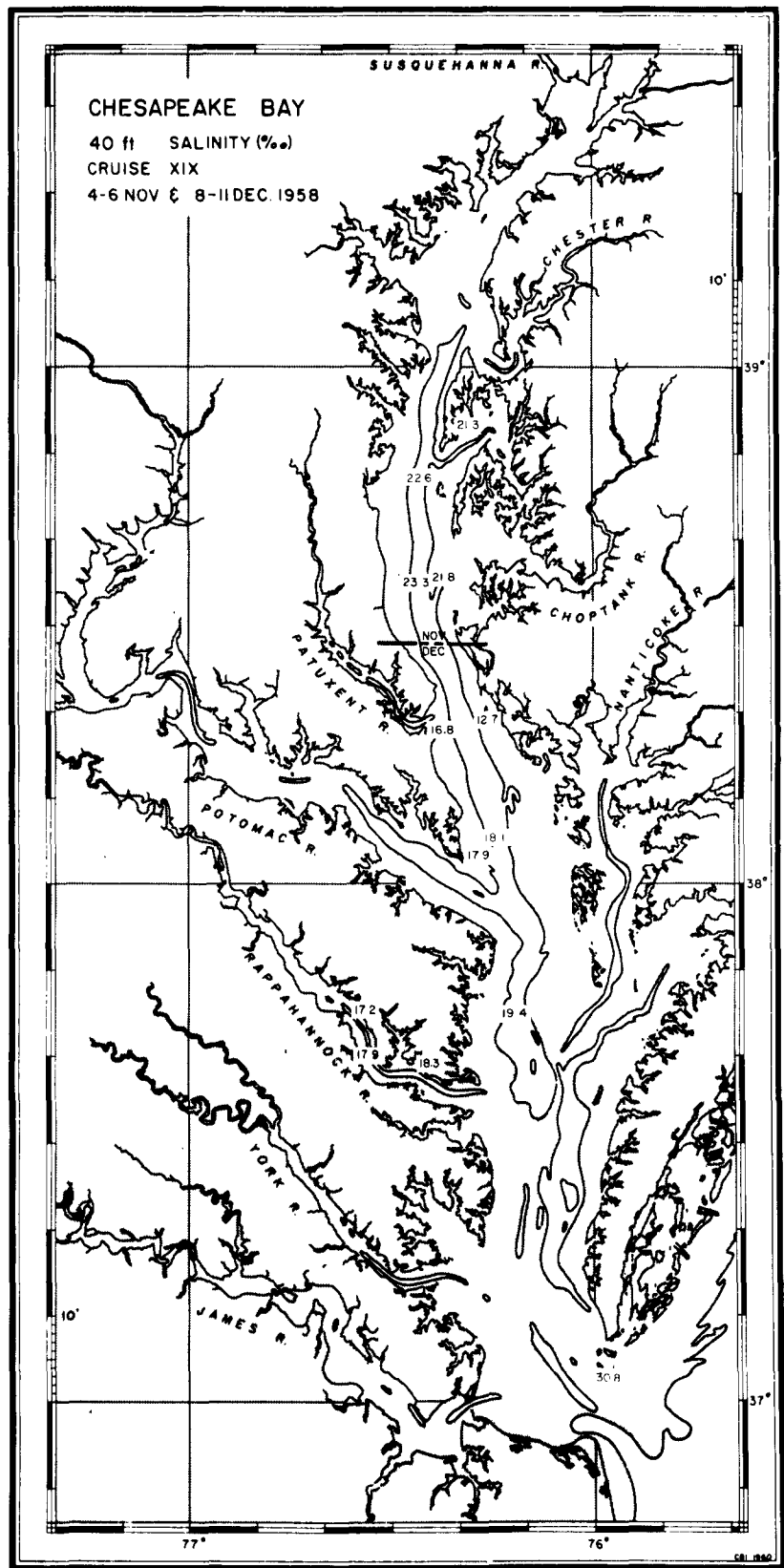


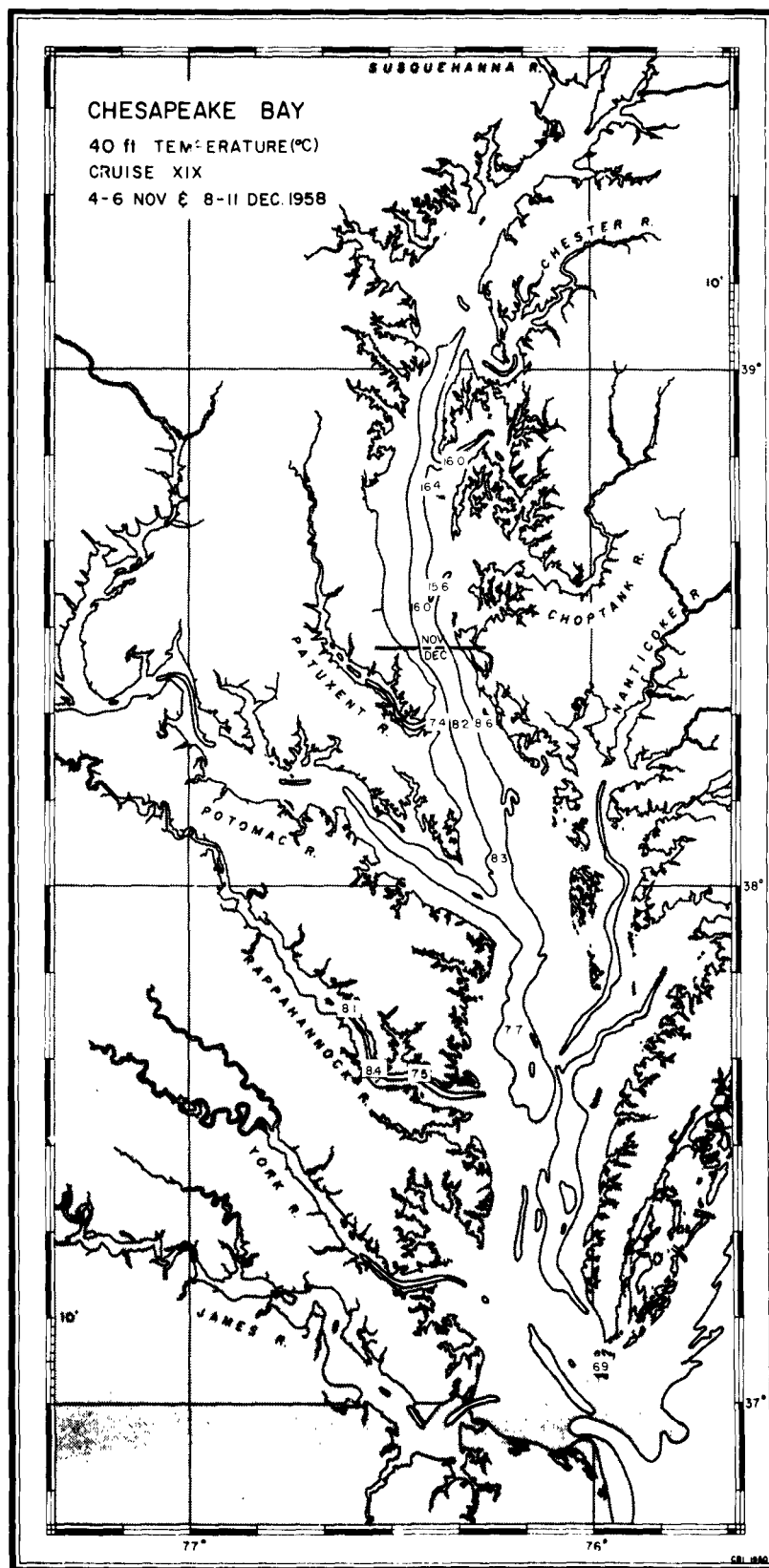


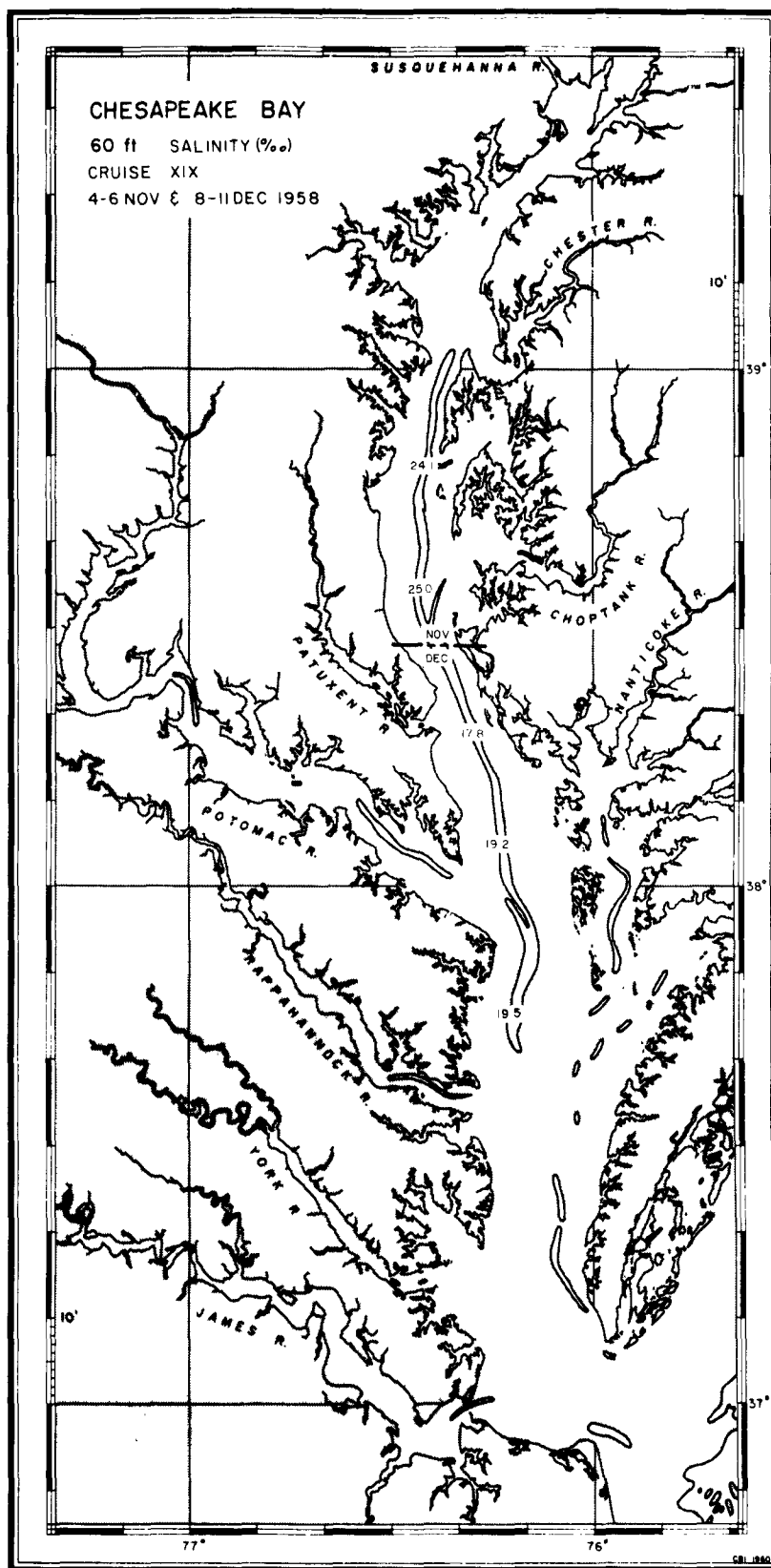


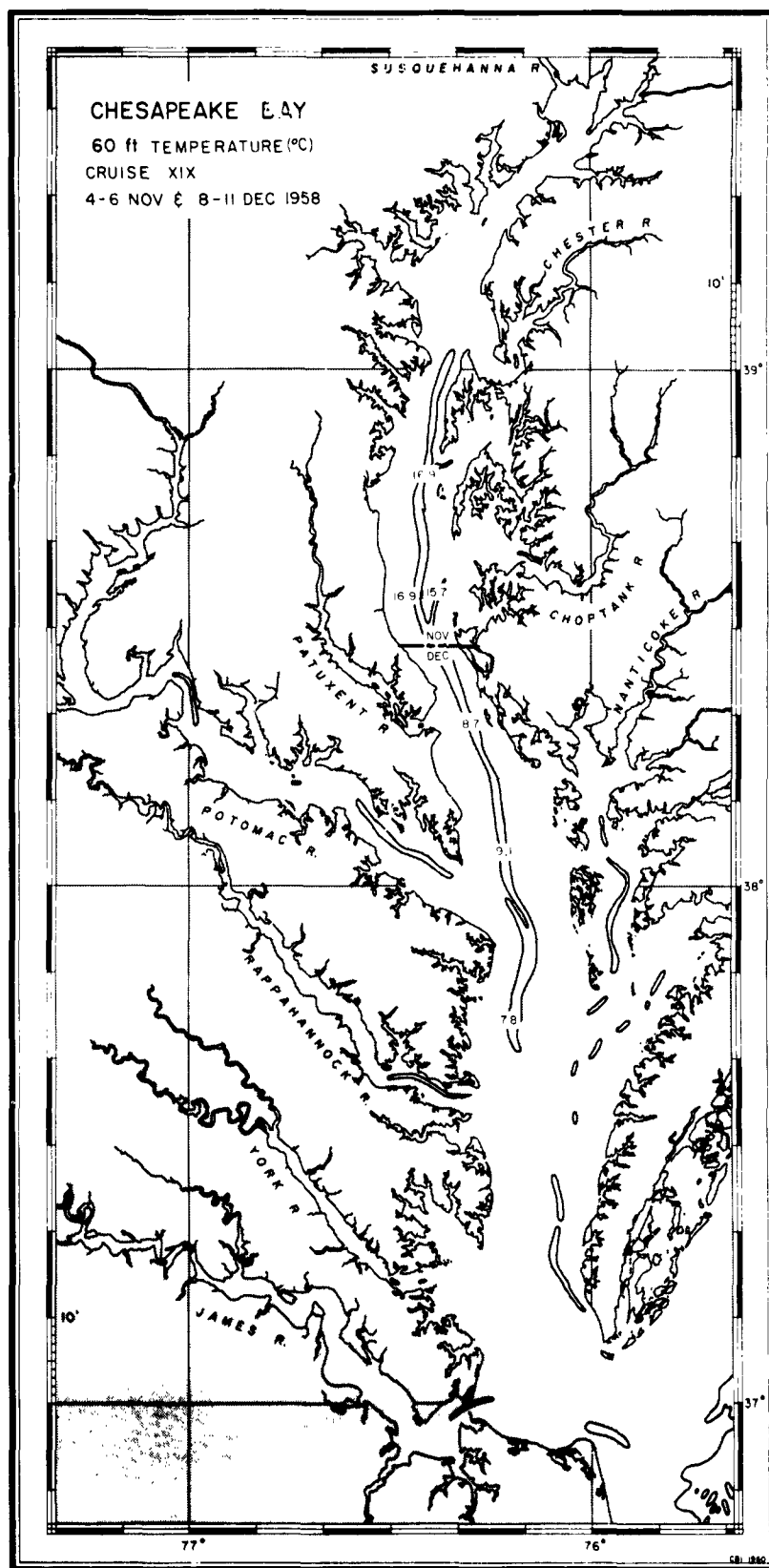






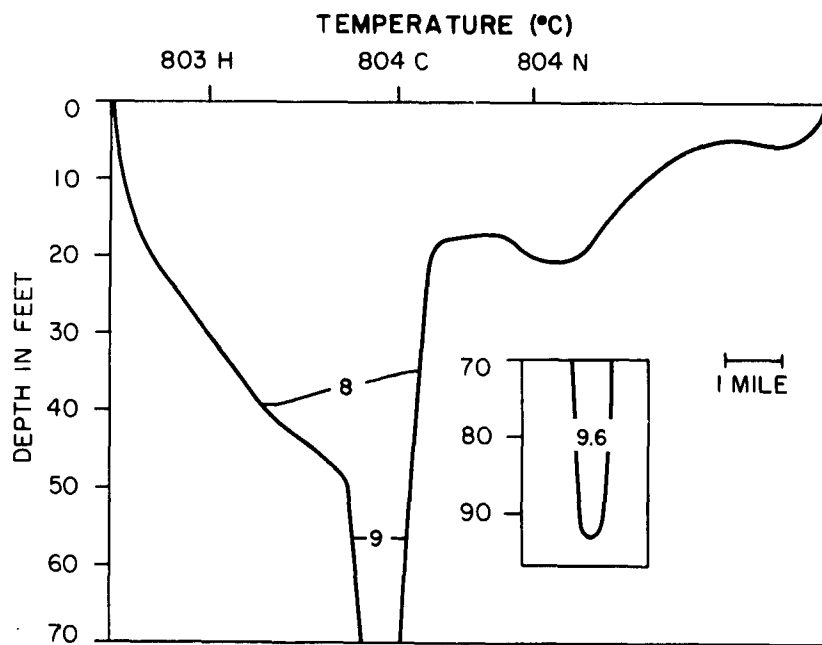
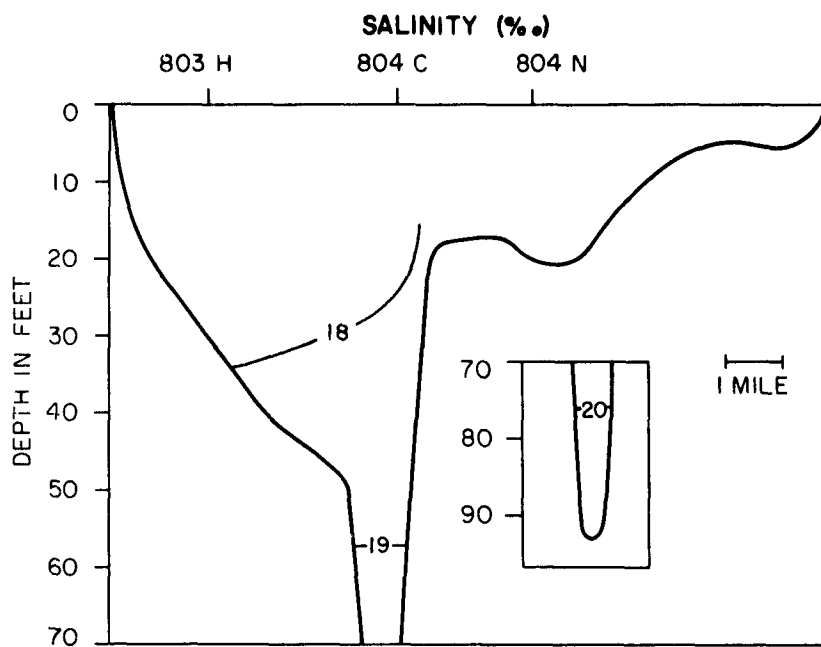




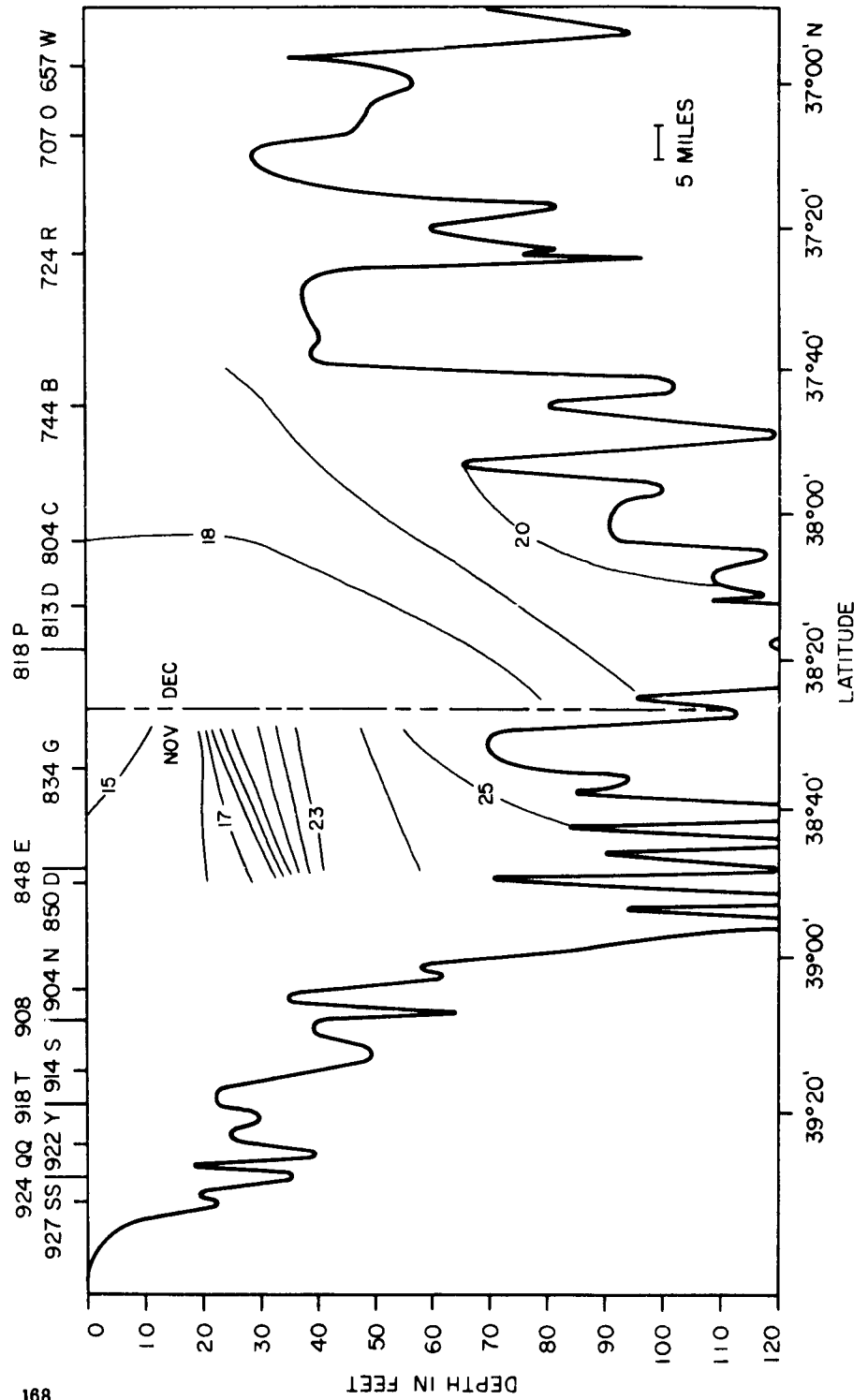


SECTIONS OMITTED
INSUFFICIENT DATA

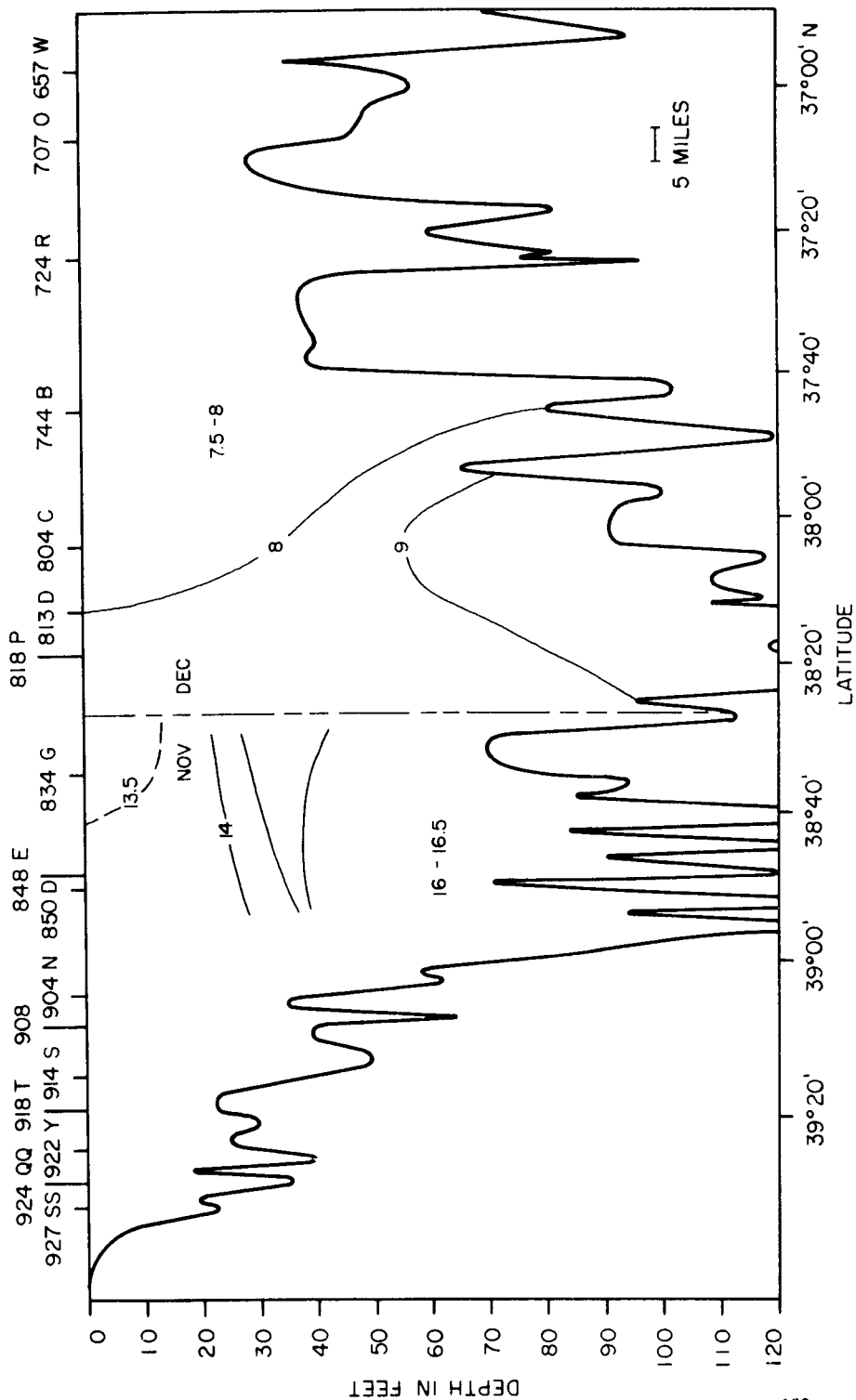
CRUISE XIX 4 - 6 NOV AND 8 - 11 DEC 1958 SECTION VI

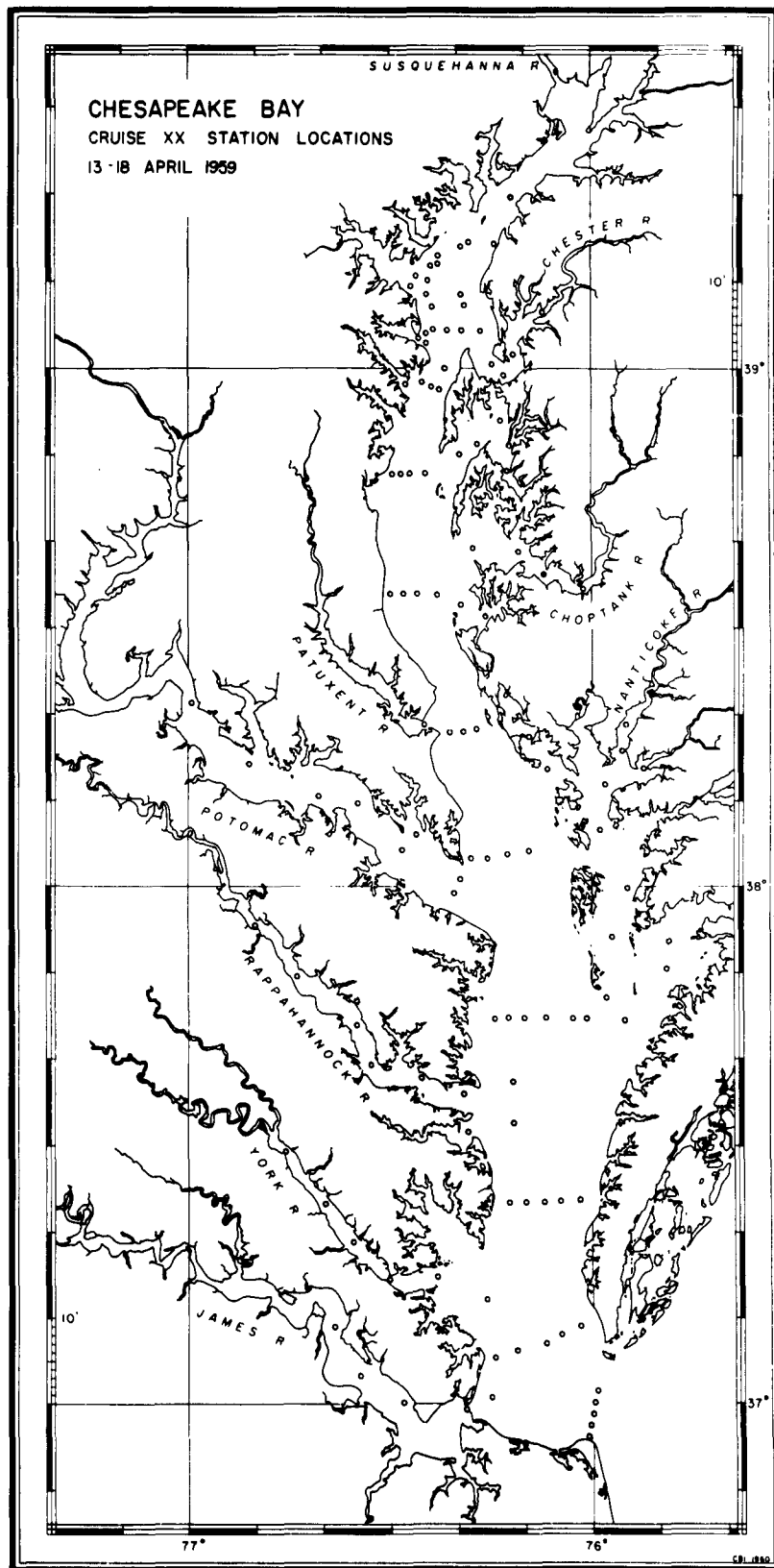


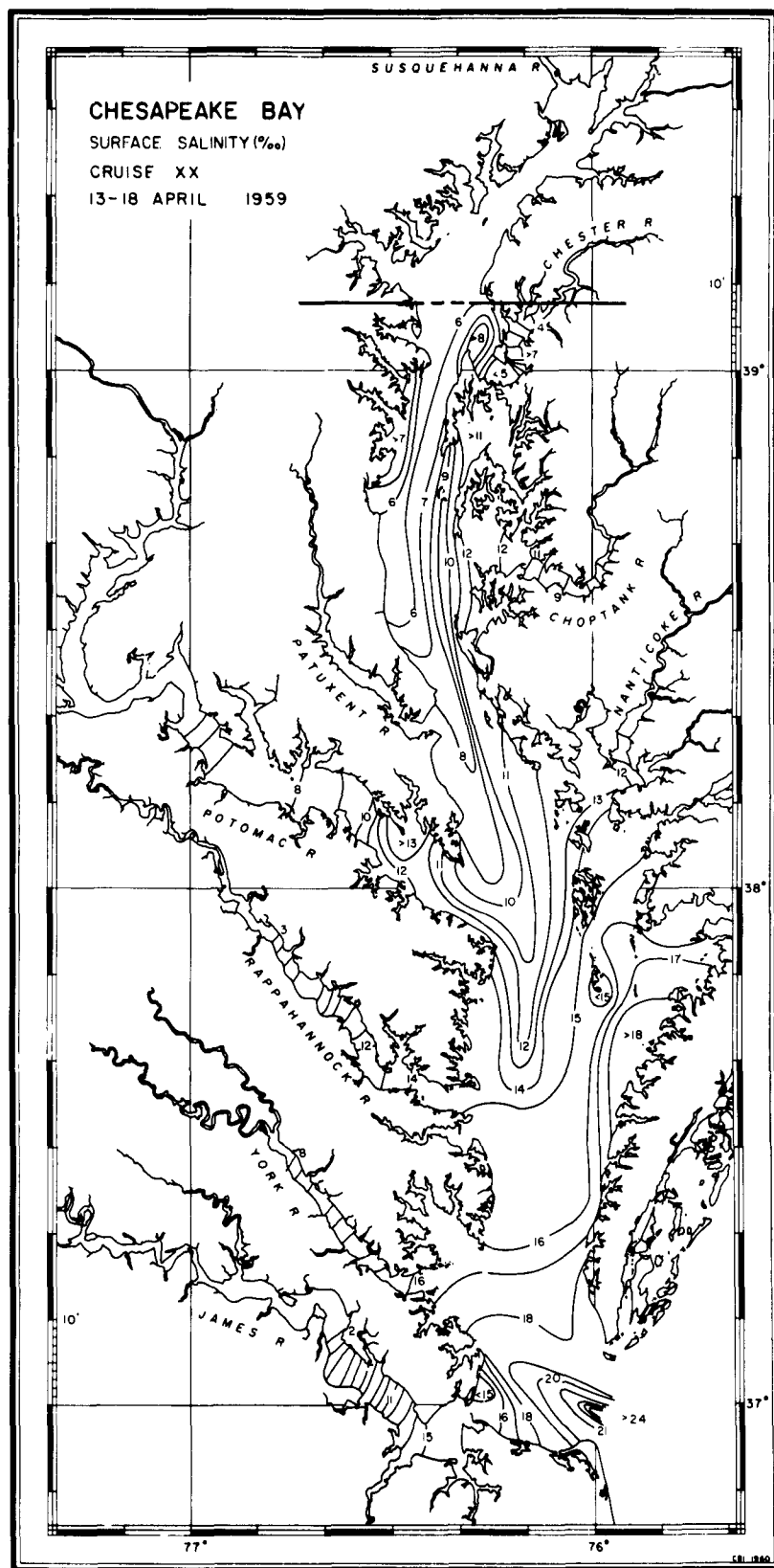
CRUISE XIX 4 - 6 NOV AND 8 - 11 DEC 1958 SECTION XIX
SALINITY (‰)

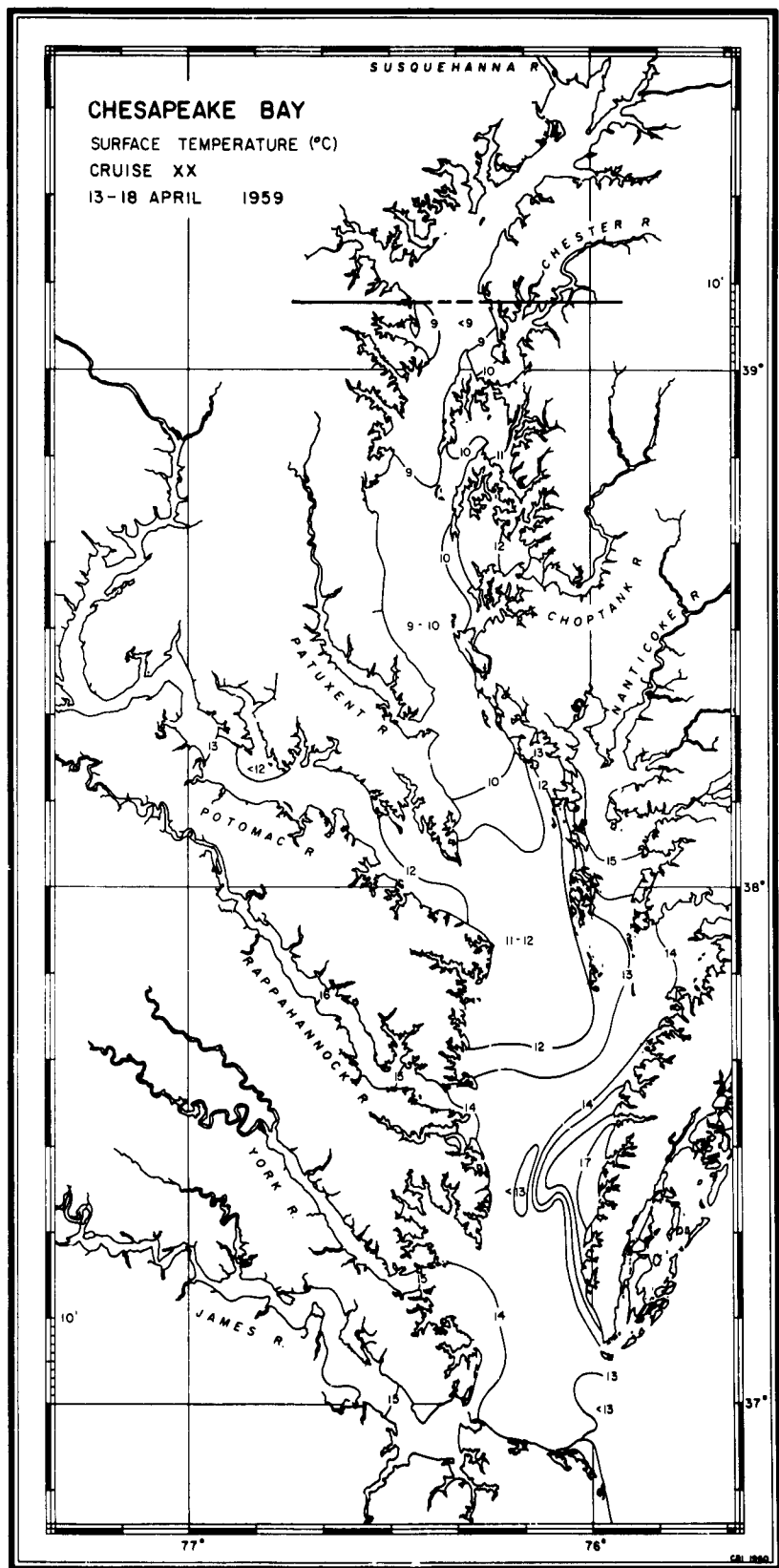


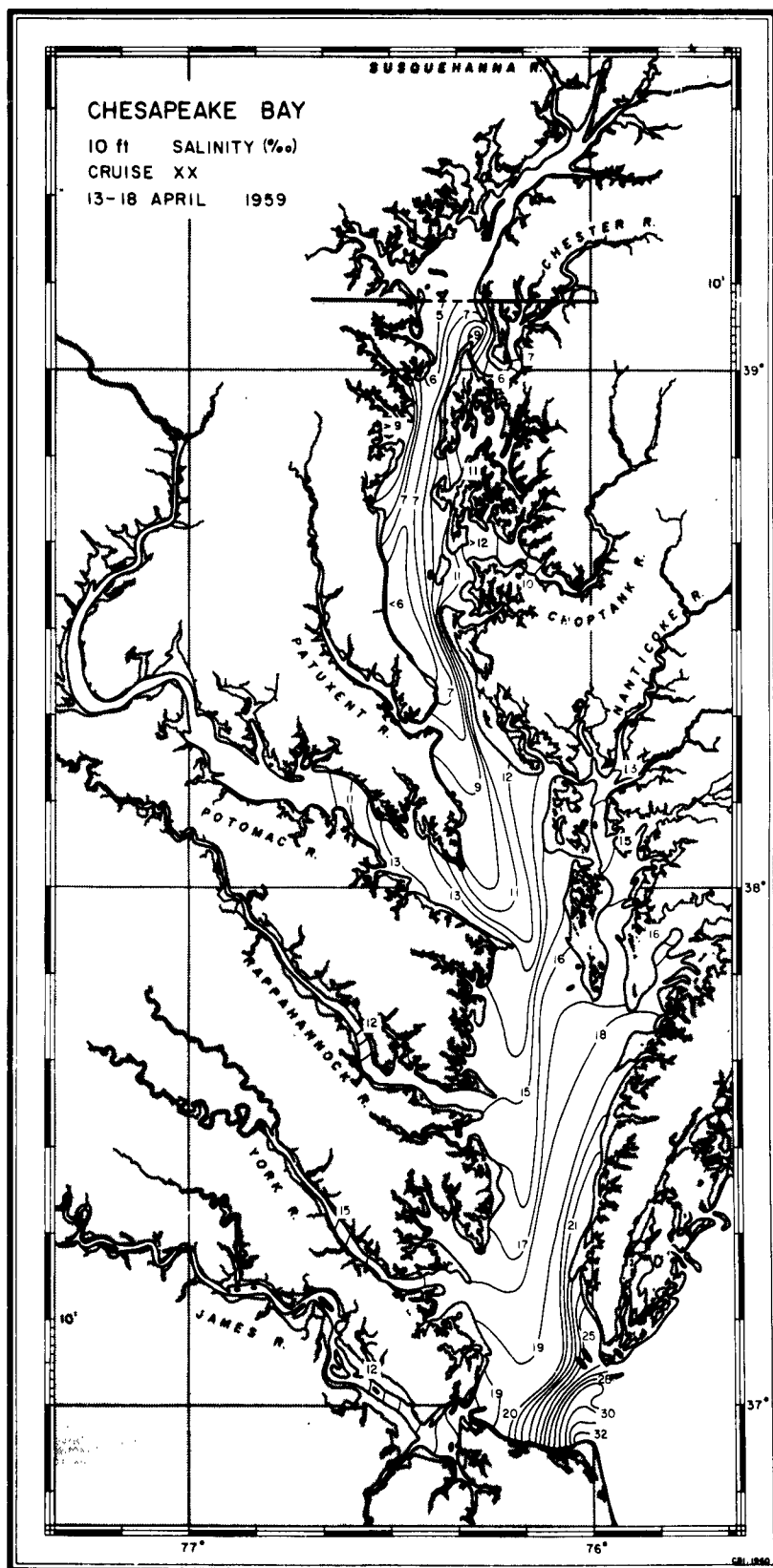
CRUISE XIX 4 - 6 NOV AND 8-11 DEC 1958 SECTION XIX
TEMPERATURE (°C)

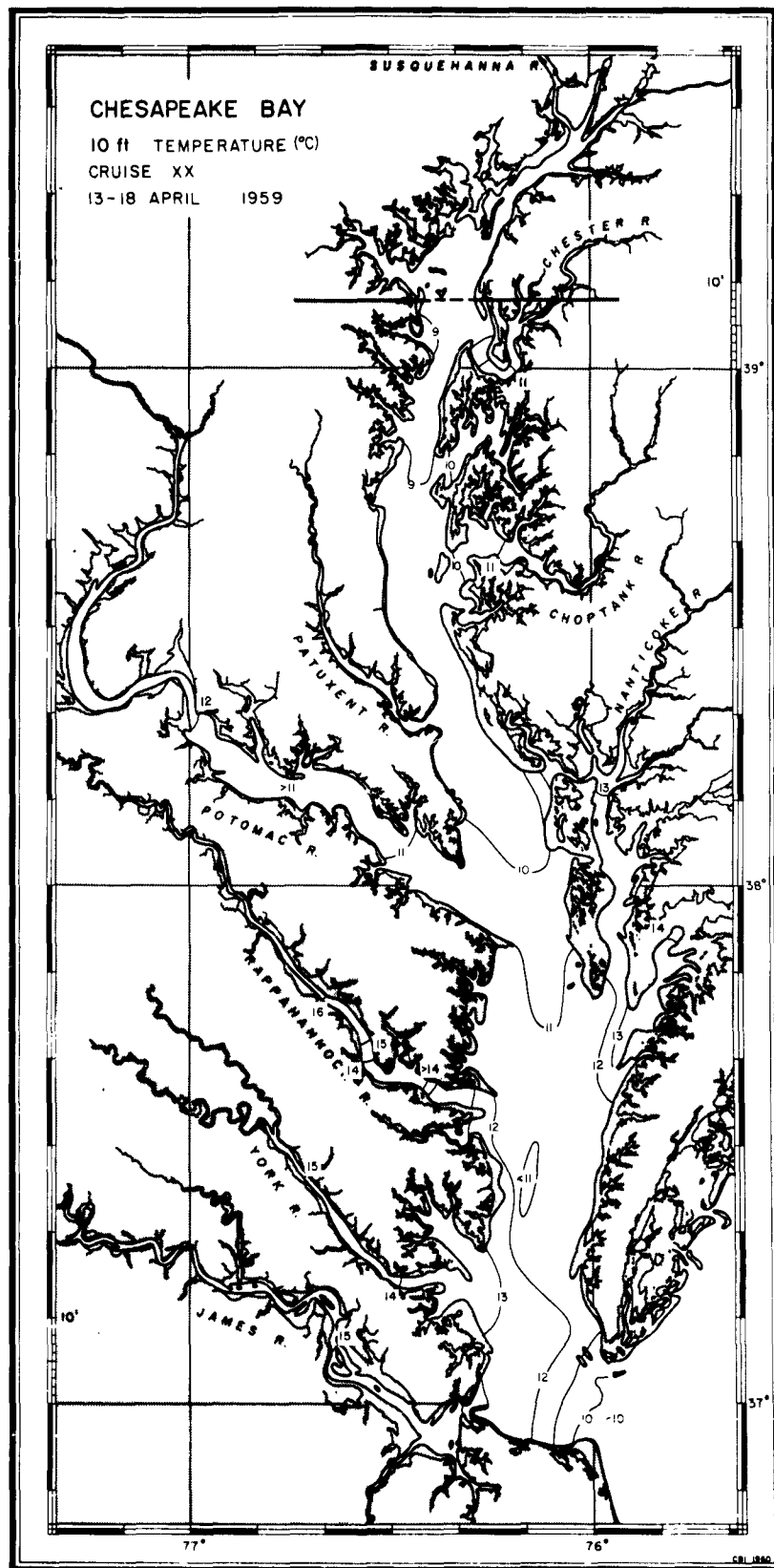


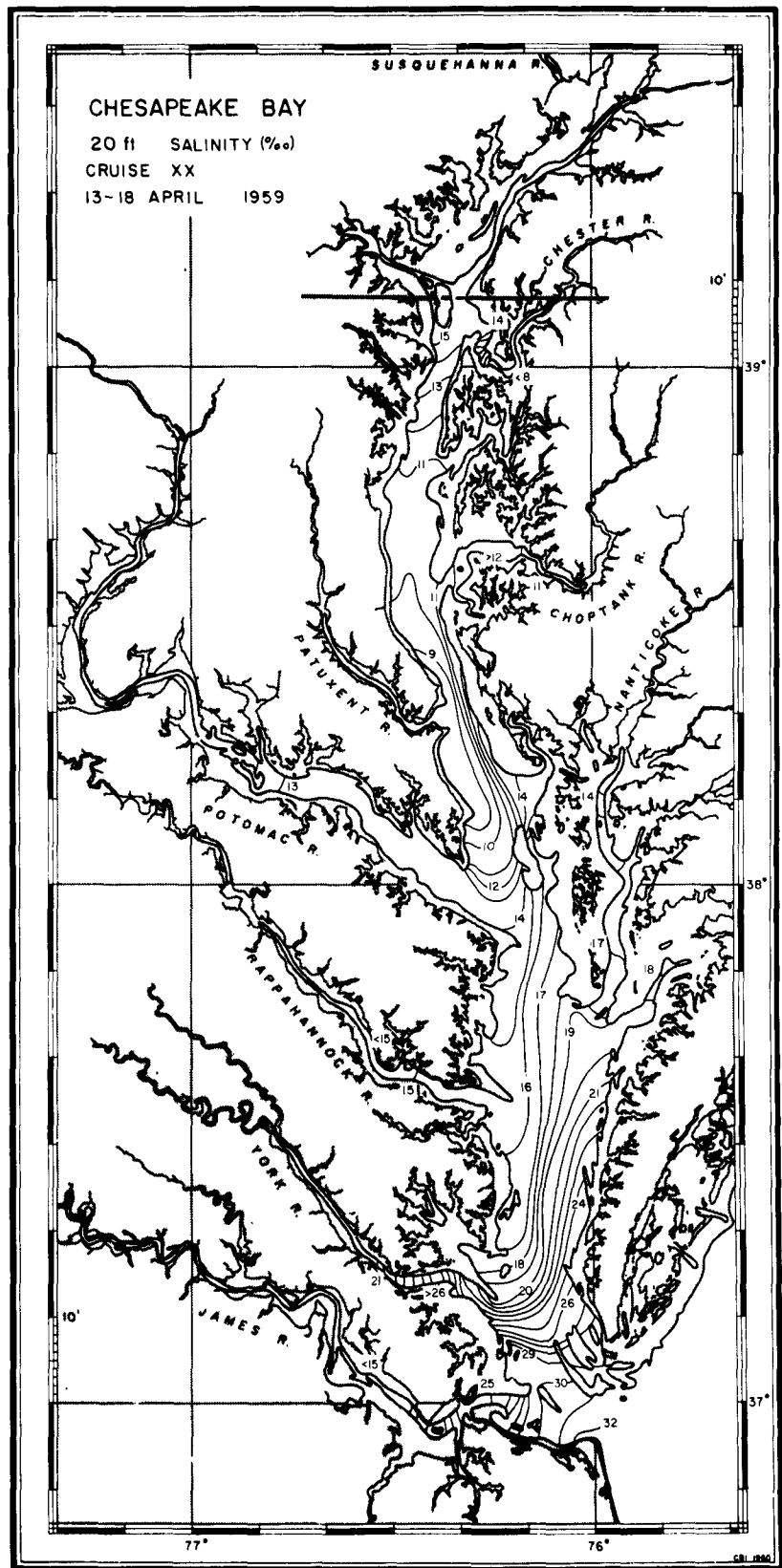


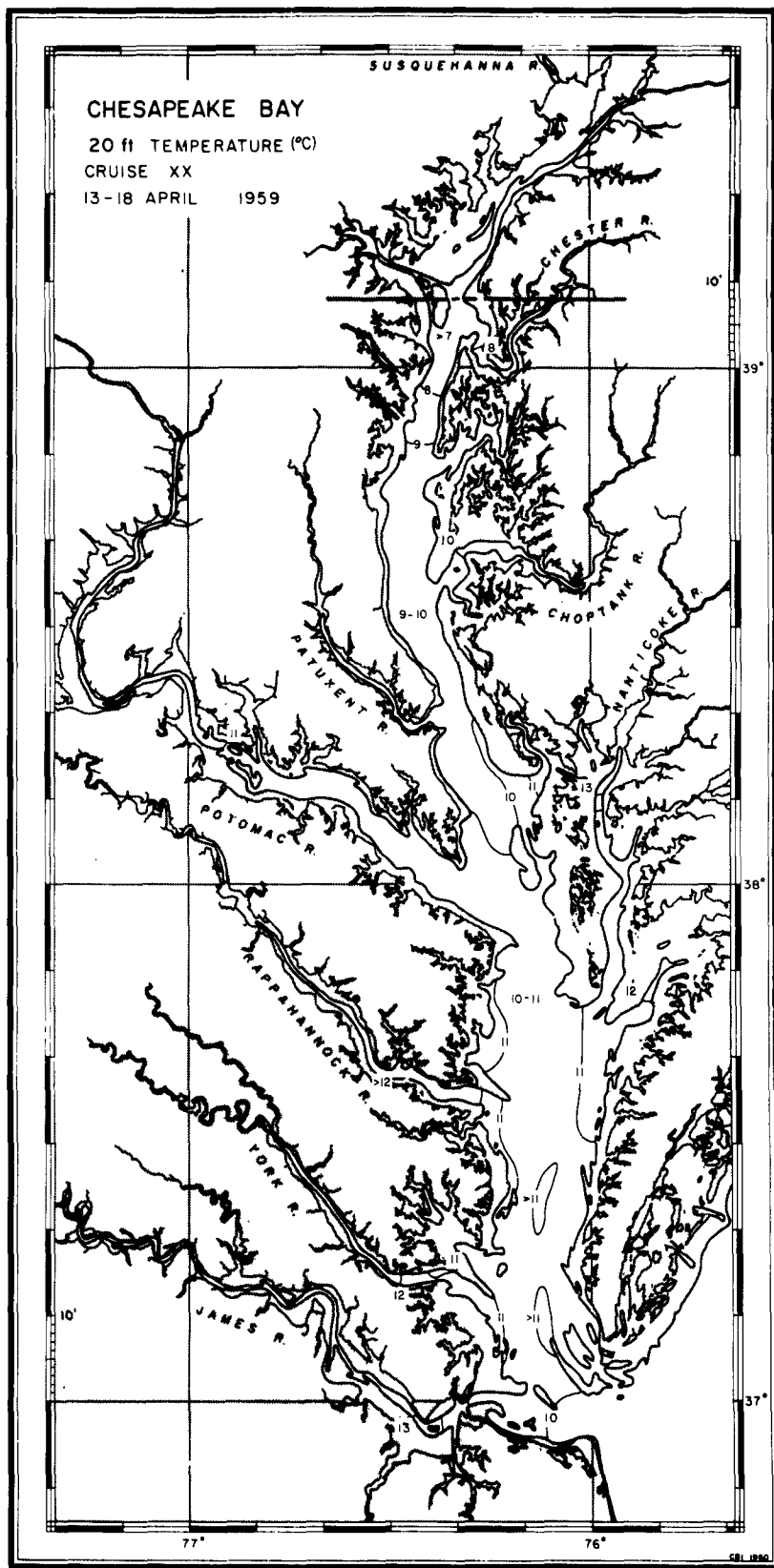


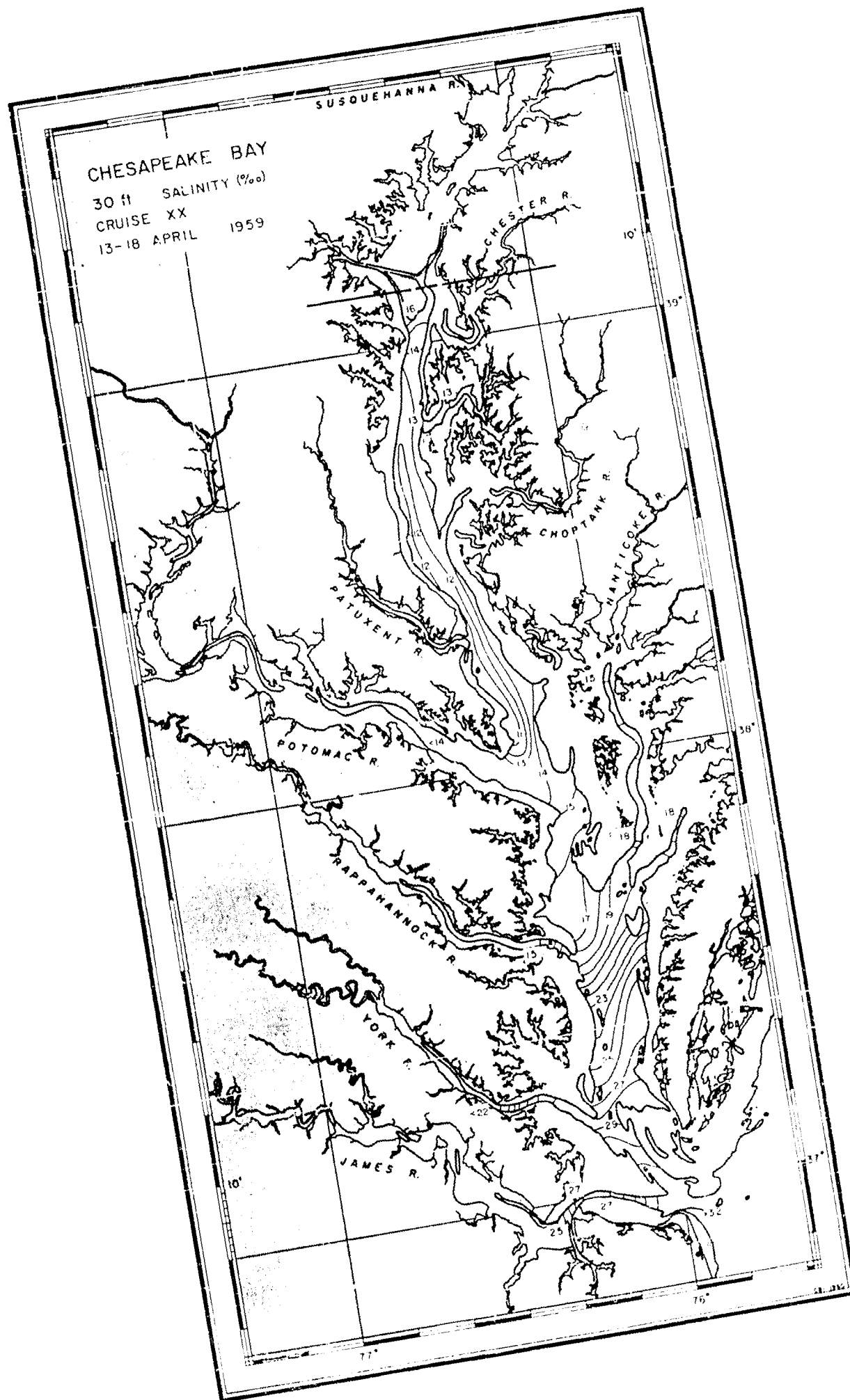


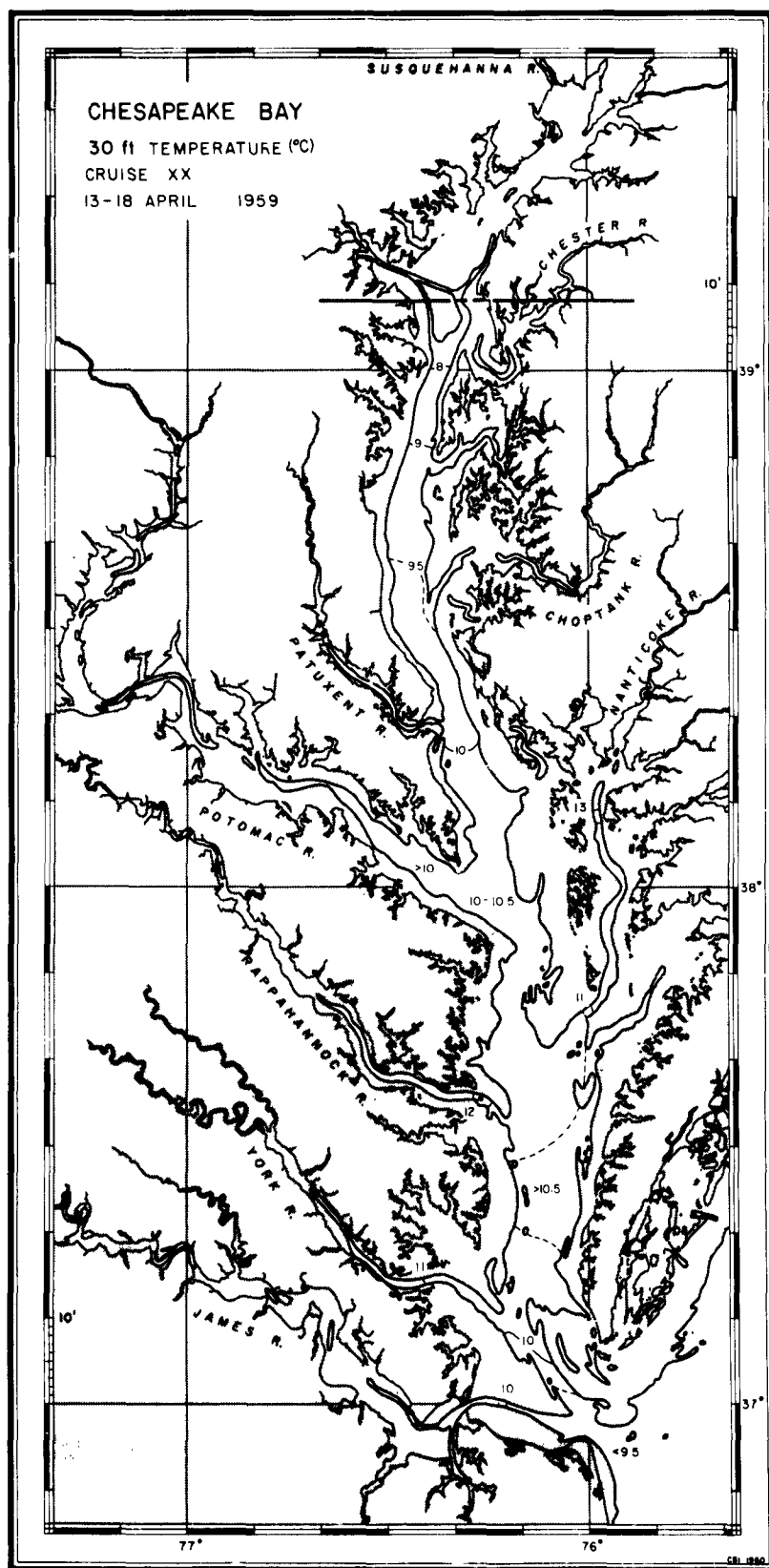


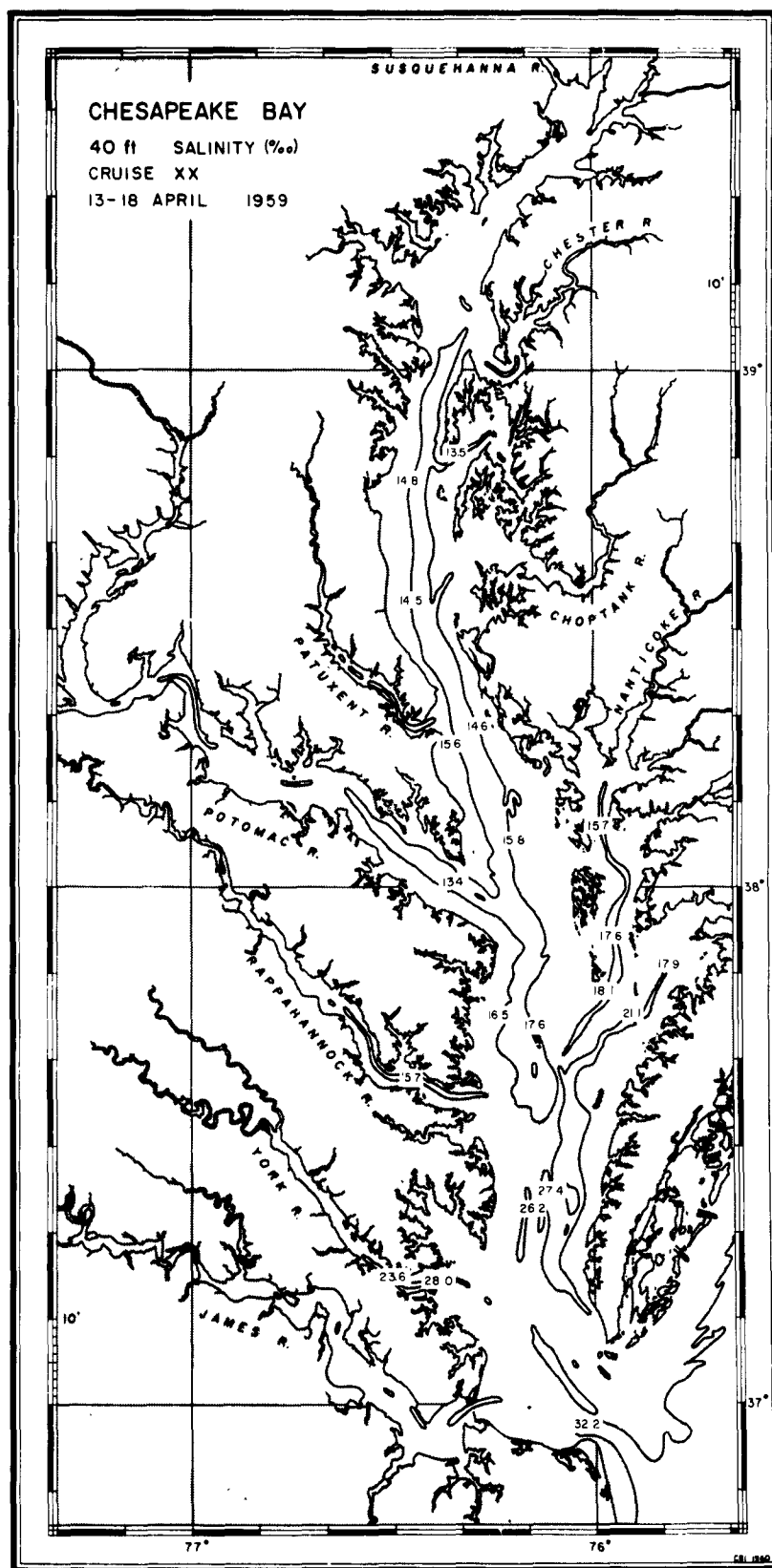


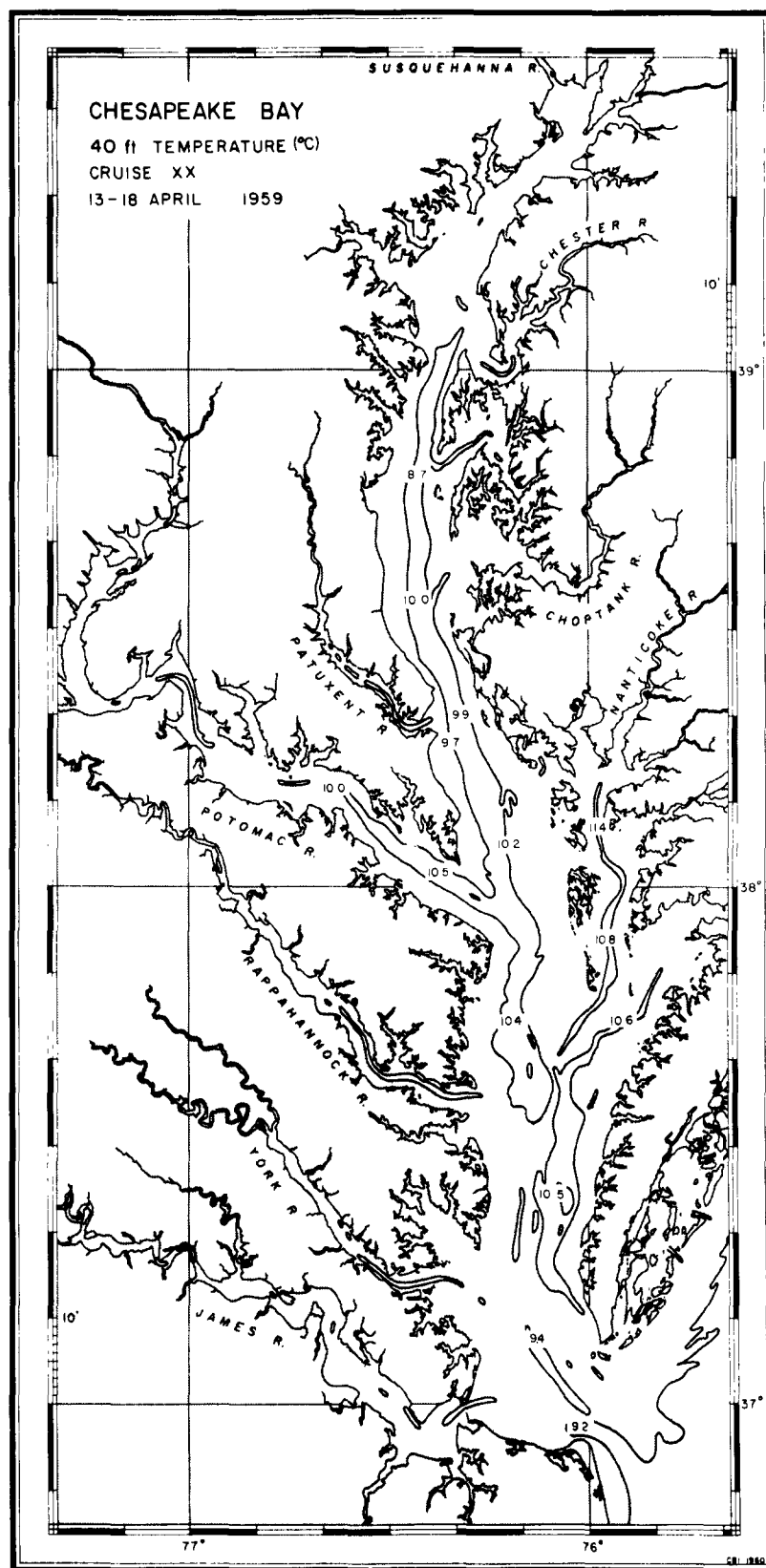


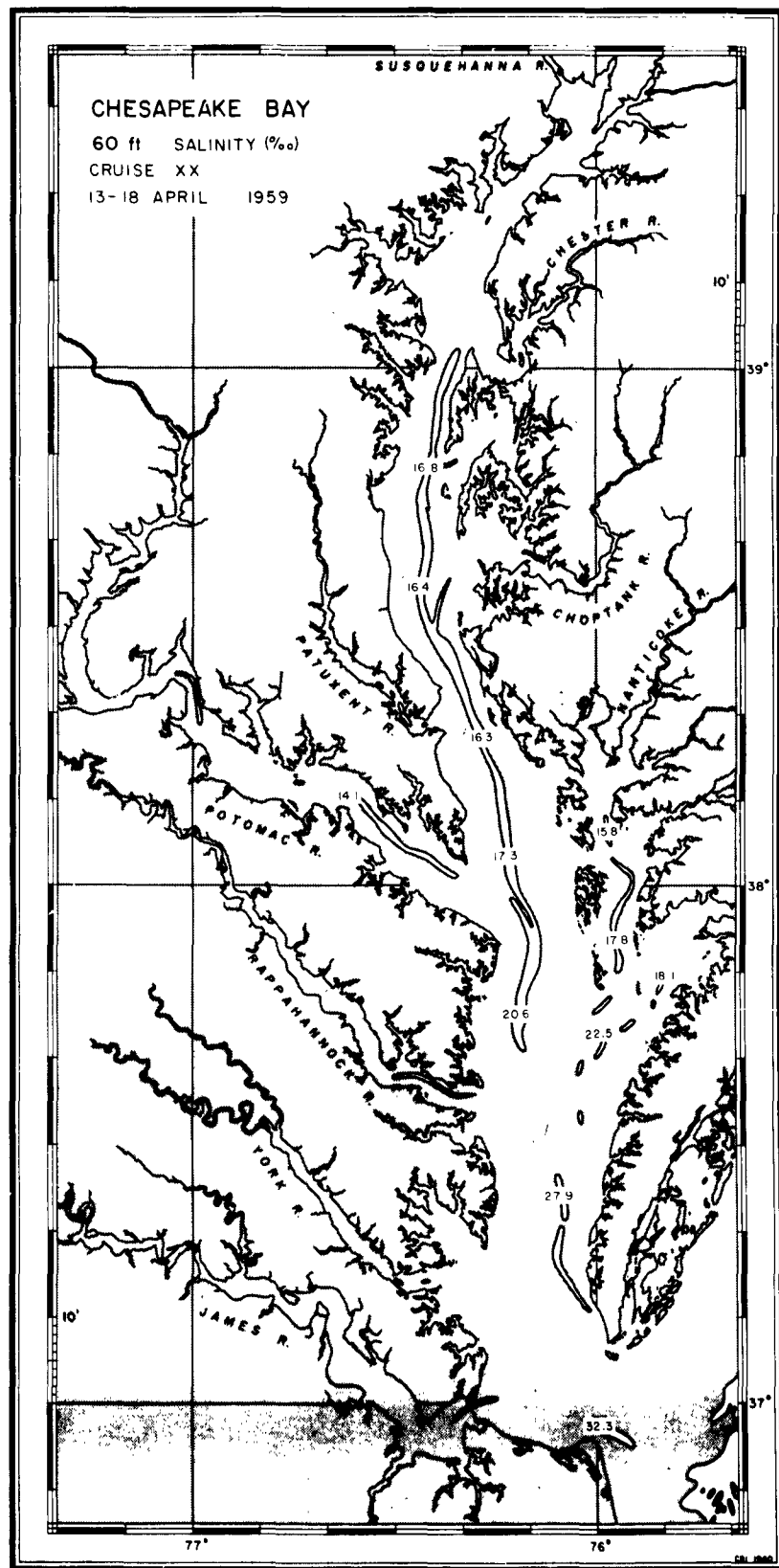


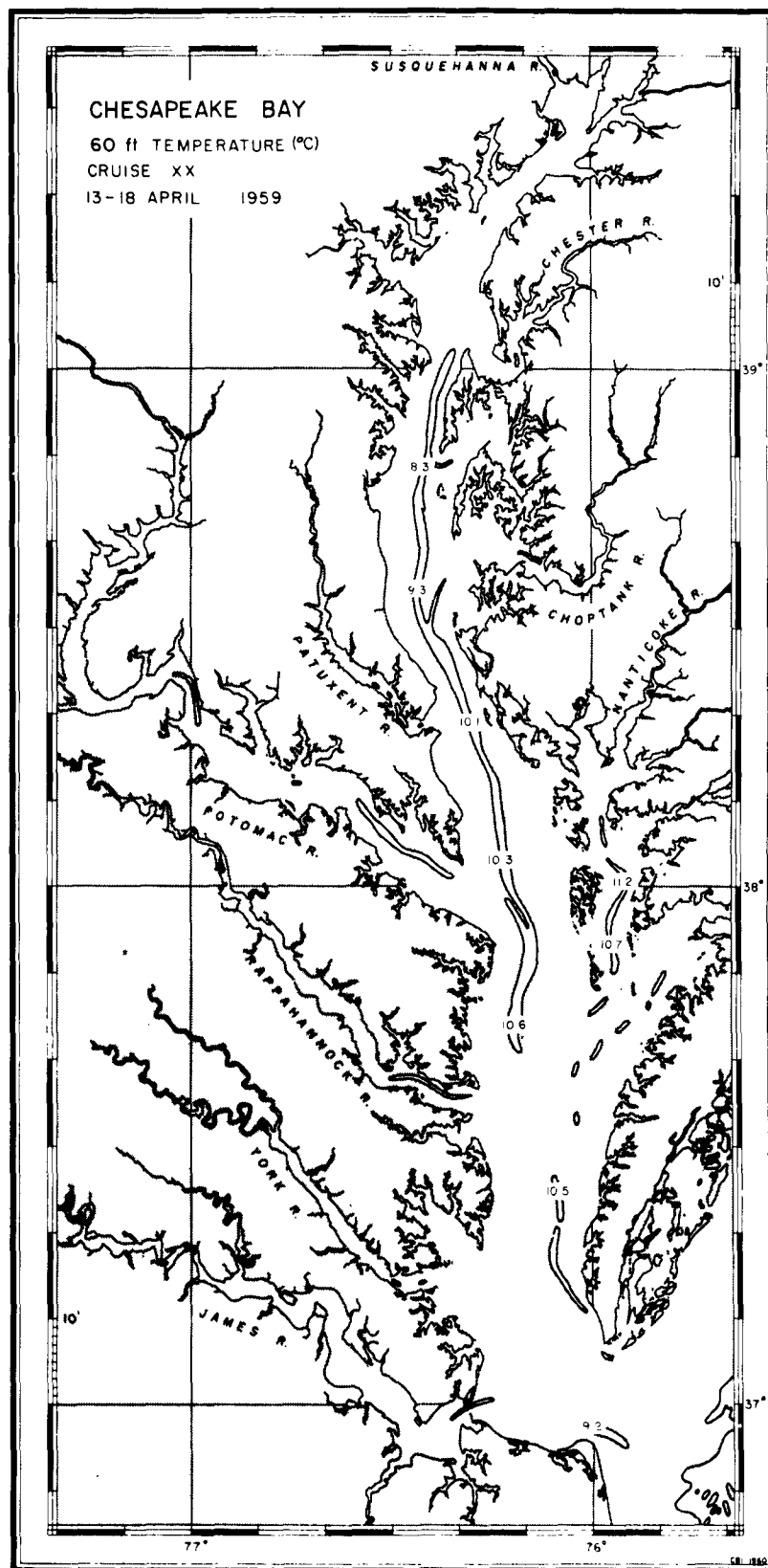




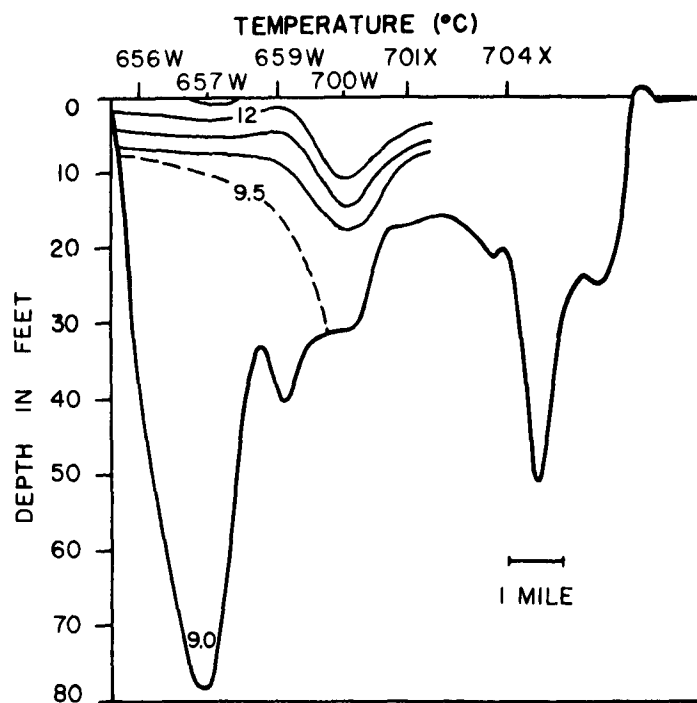
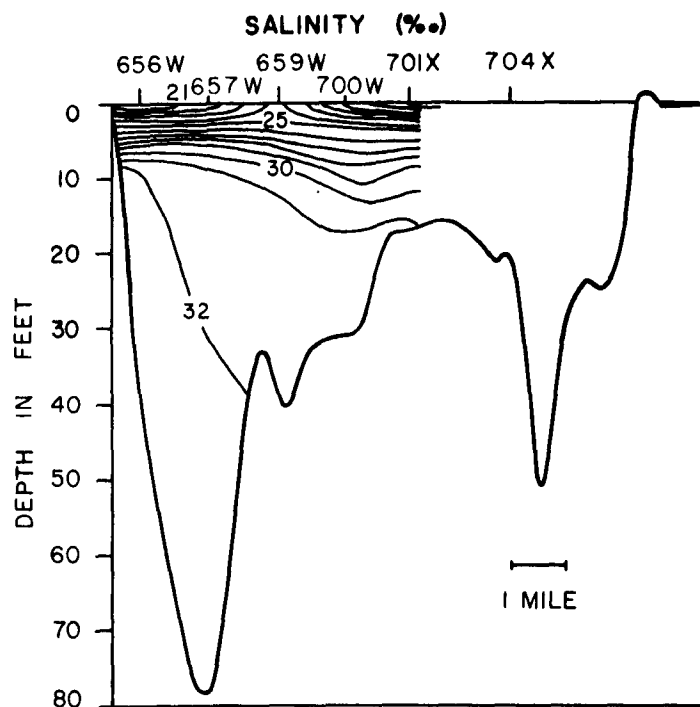




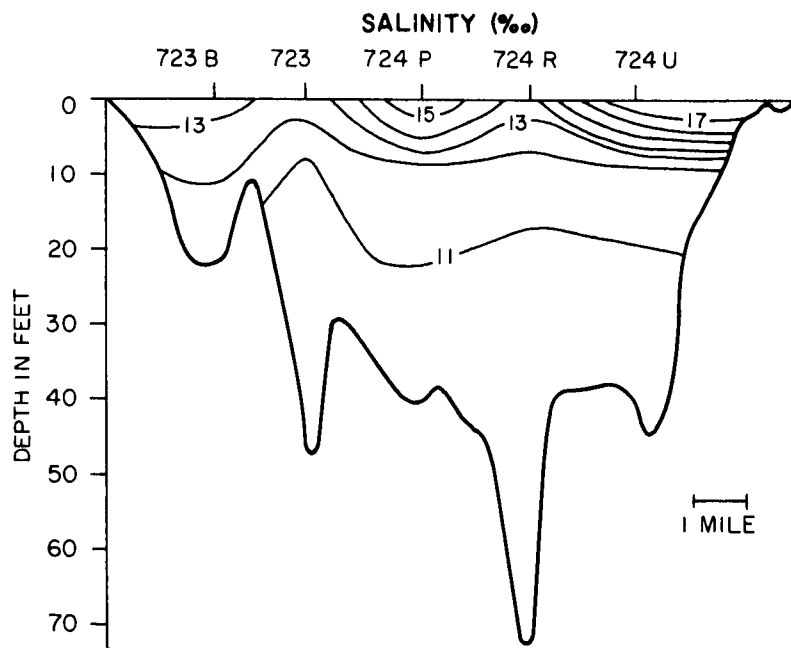
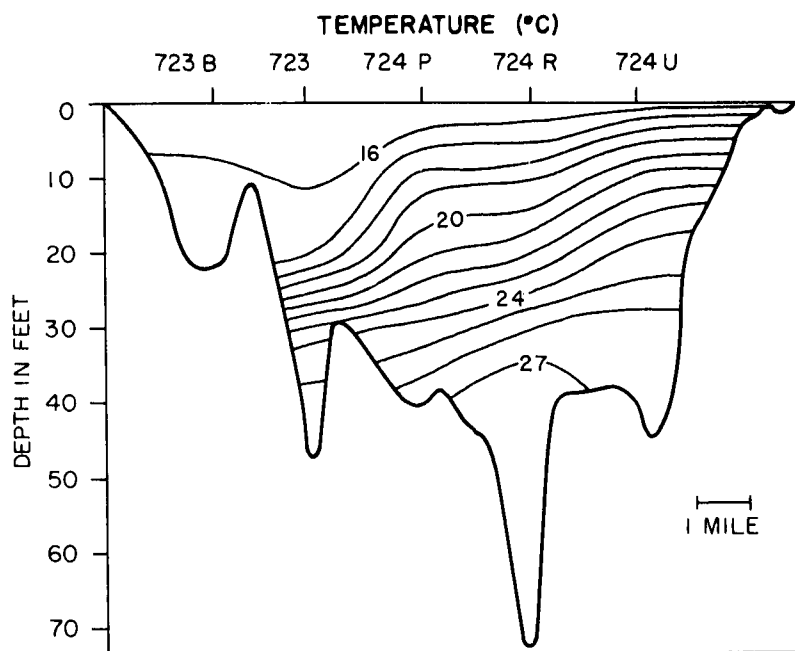




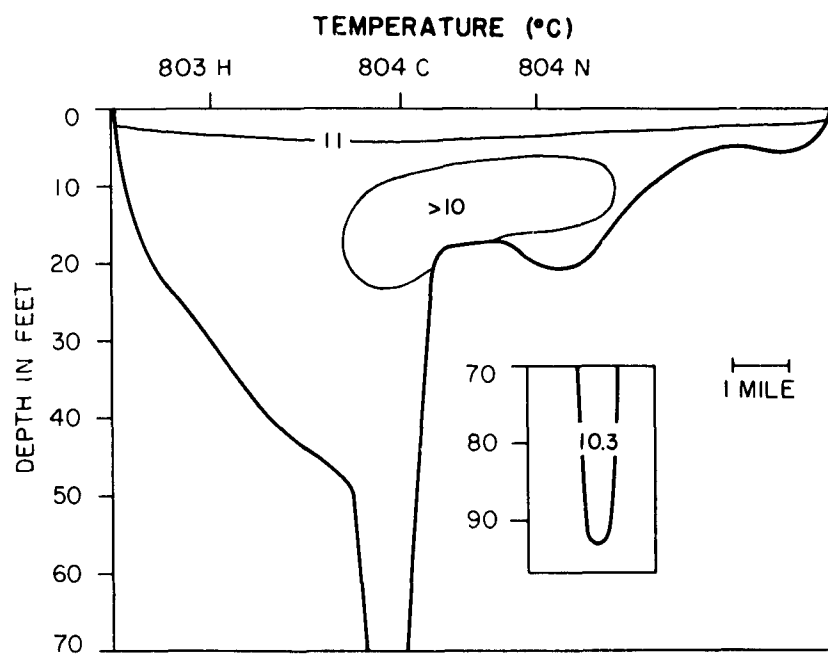
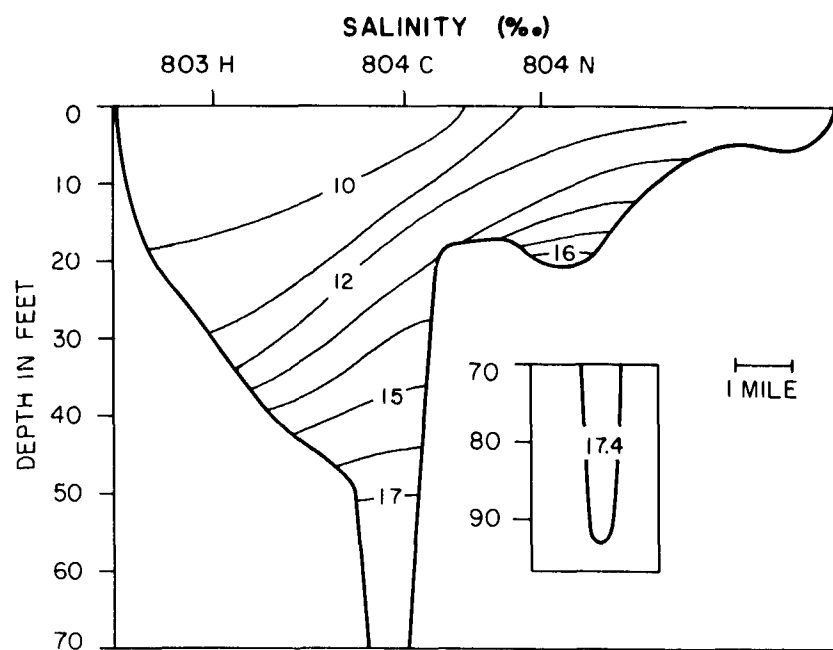
CRUISE XX 13 - 18 APRIL 1959 SECTION II



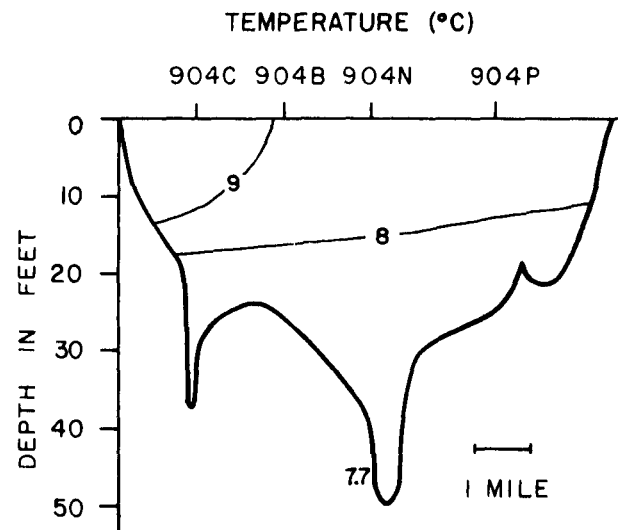
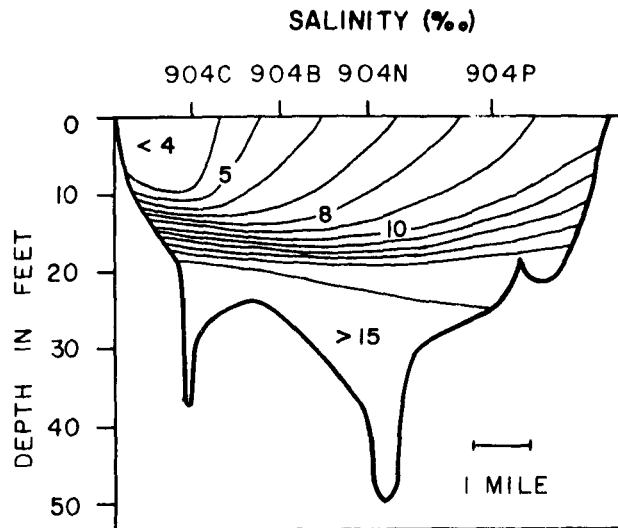
CRUISE XX 13 - 18 APRIL 1959 SECTION IV



CRUISE XX 13 - 18 APRIL 1959 SECTION VI



CRUISE XX 13 - 18 APRIL 1959 SECTION X

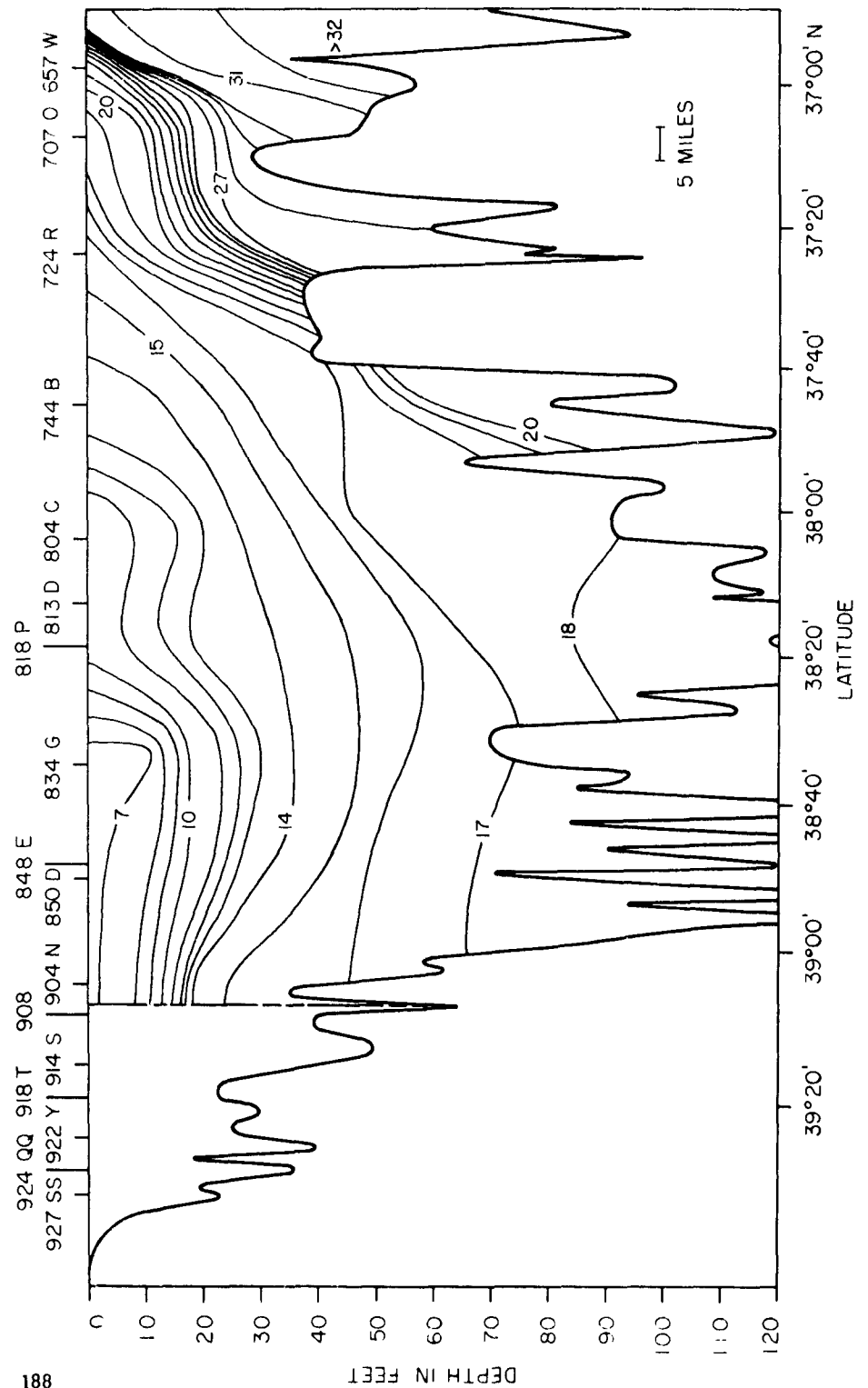


CRUISE XX

13 - 18 APRIL 1959

SECTION XIX

SALINITY (‰)

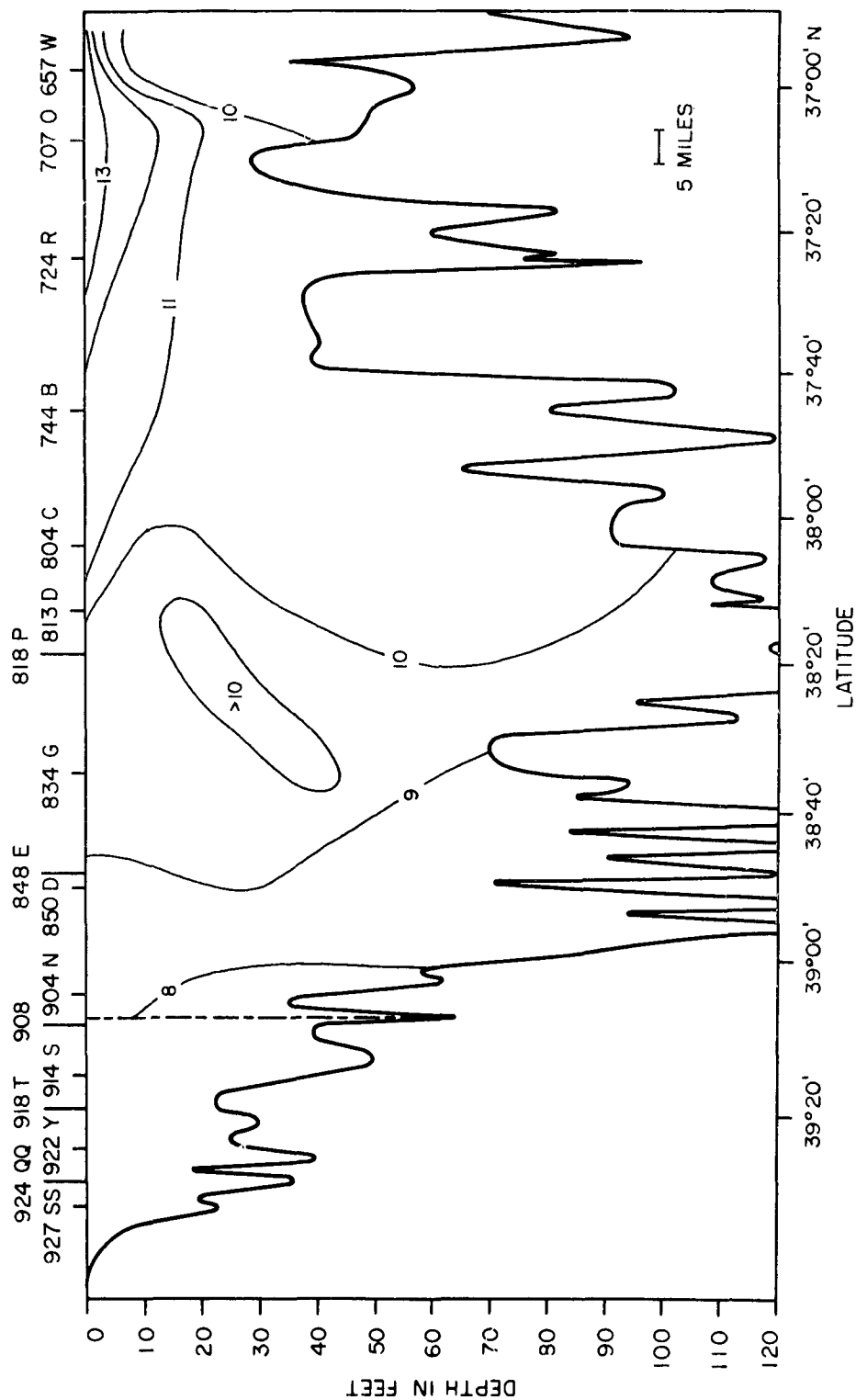


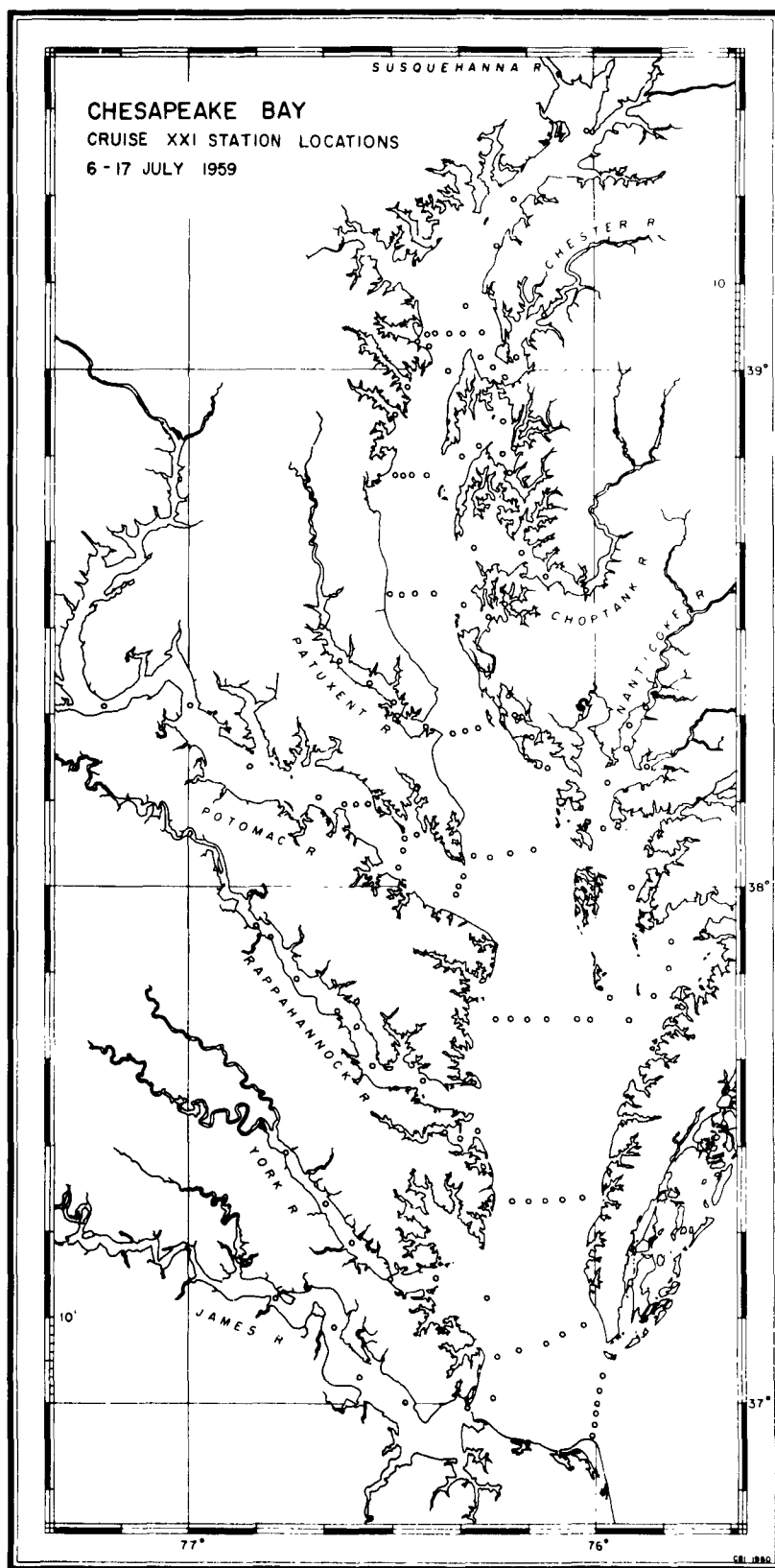
CRUISE XX

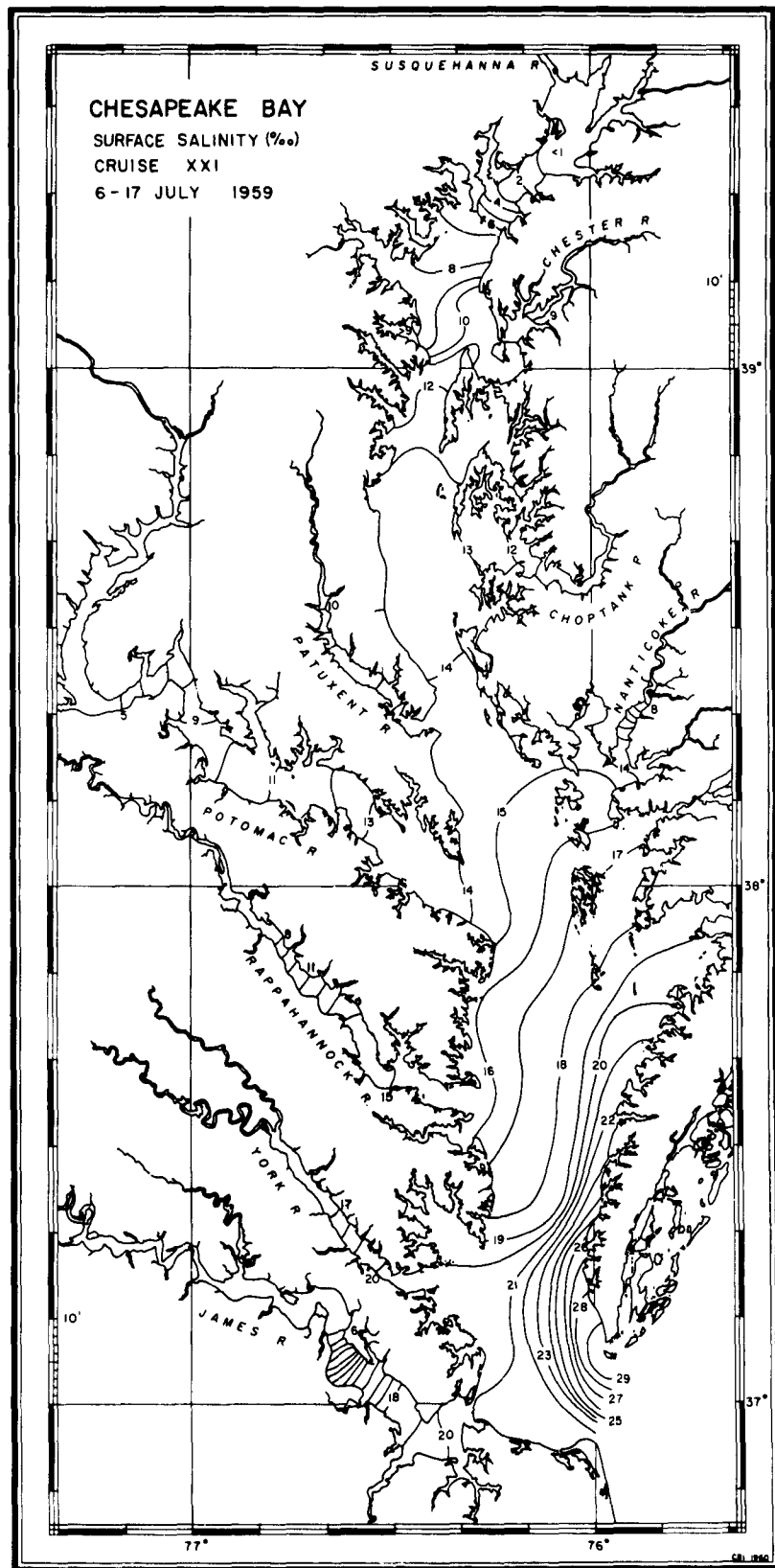
13 - 18 APRIL 1959

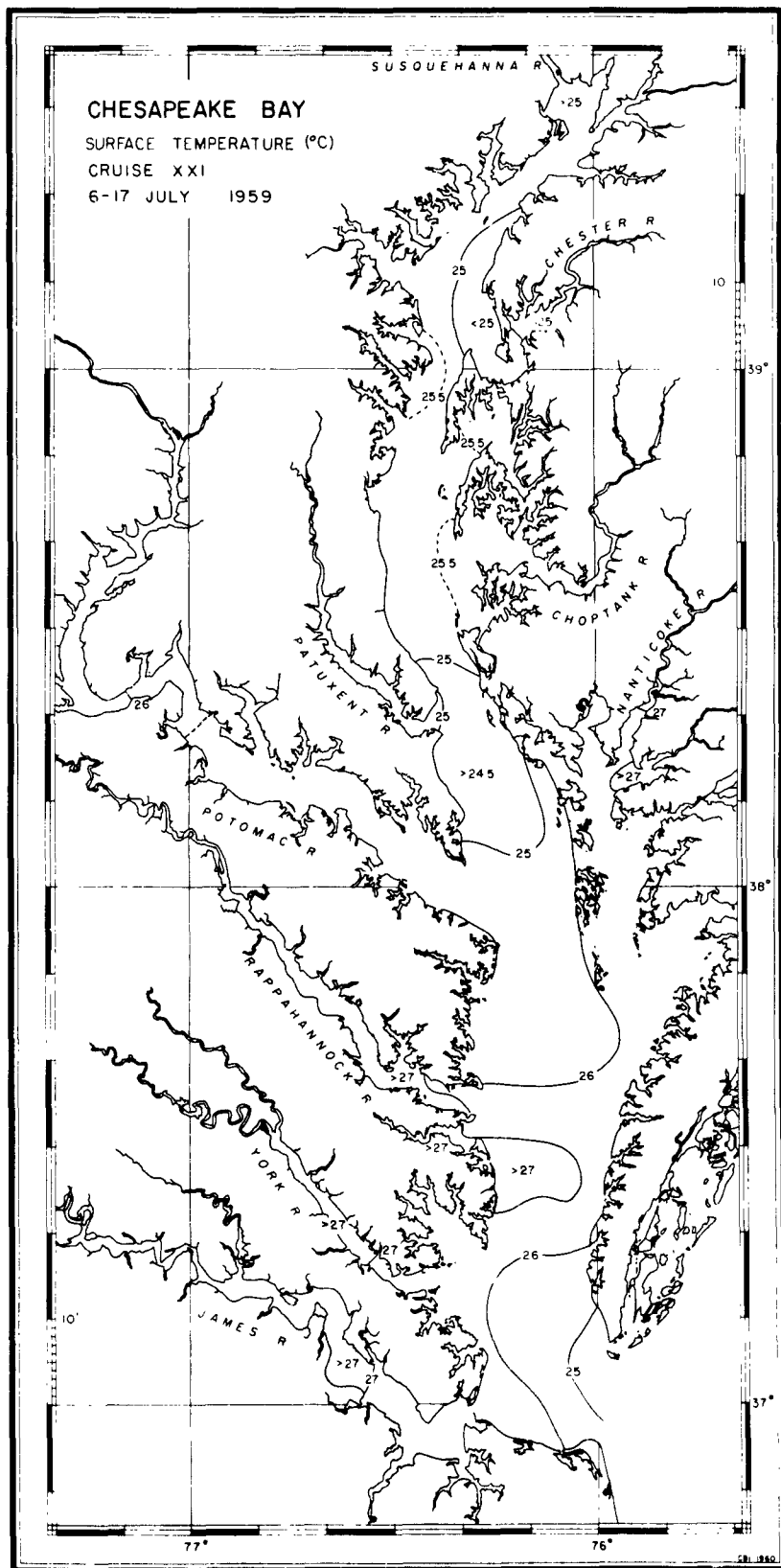
SECTION XIX

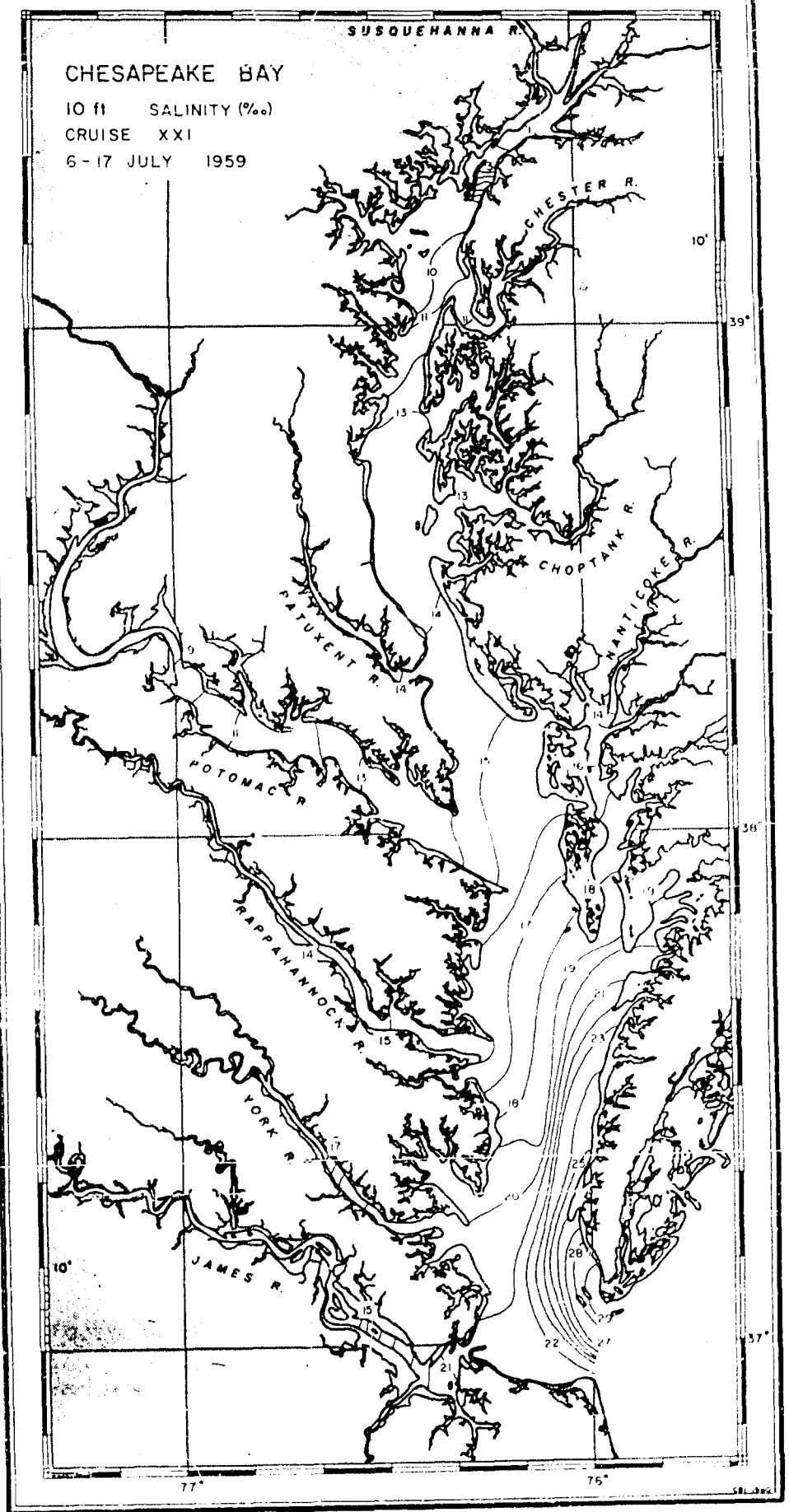
TEMPERATURE (°C)

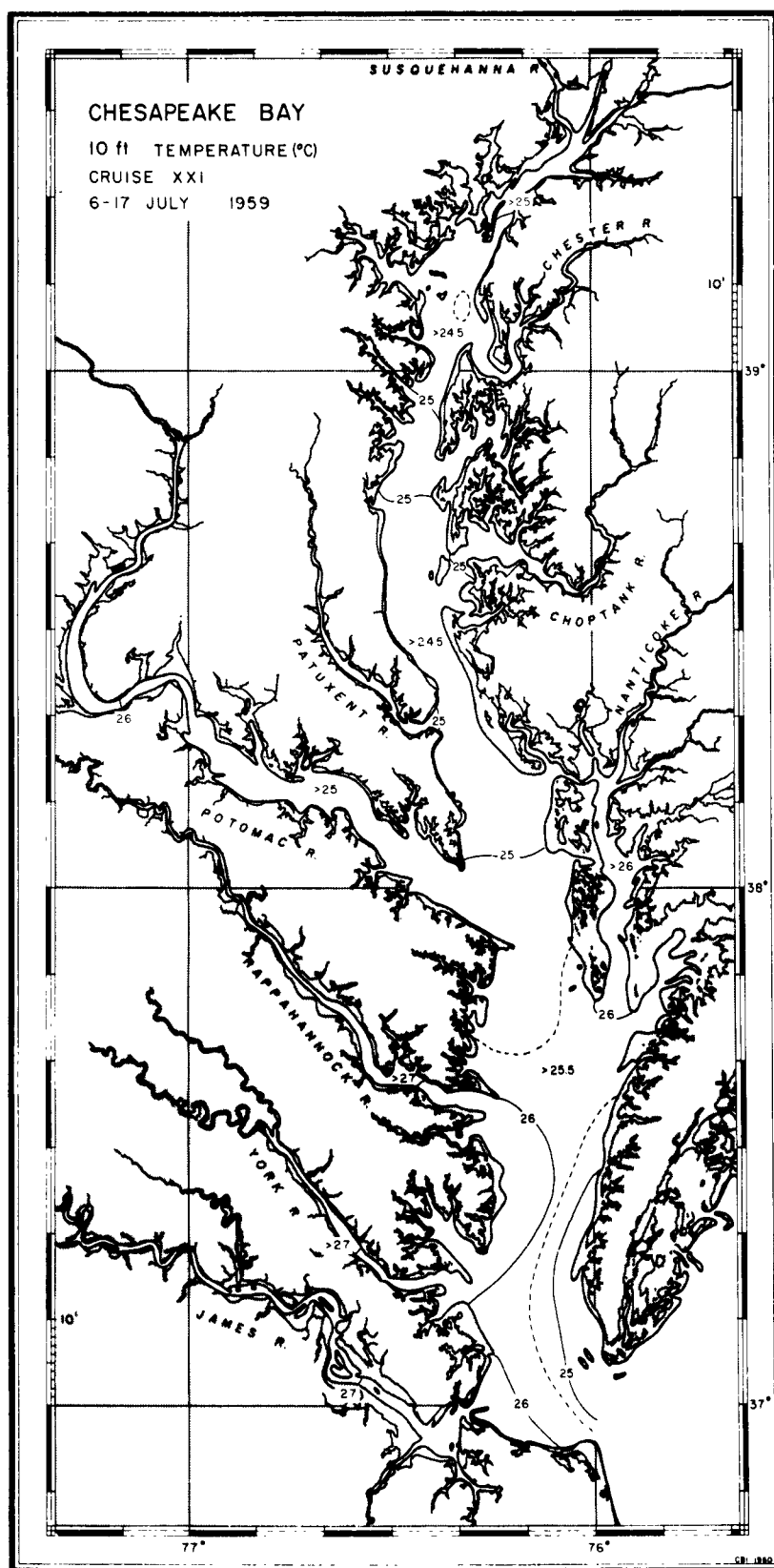


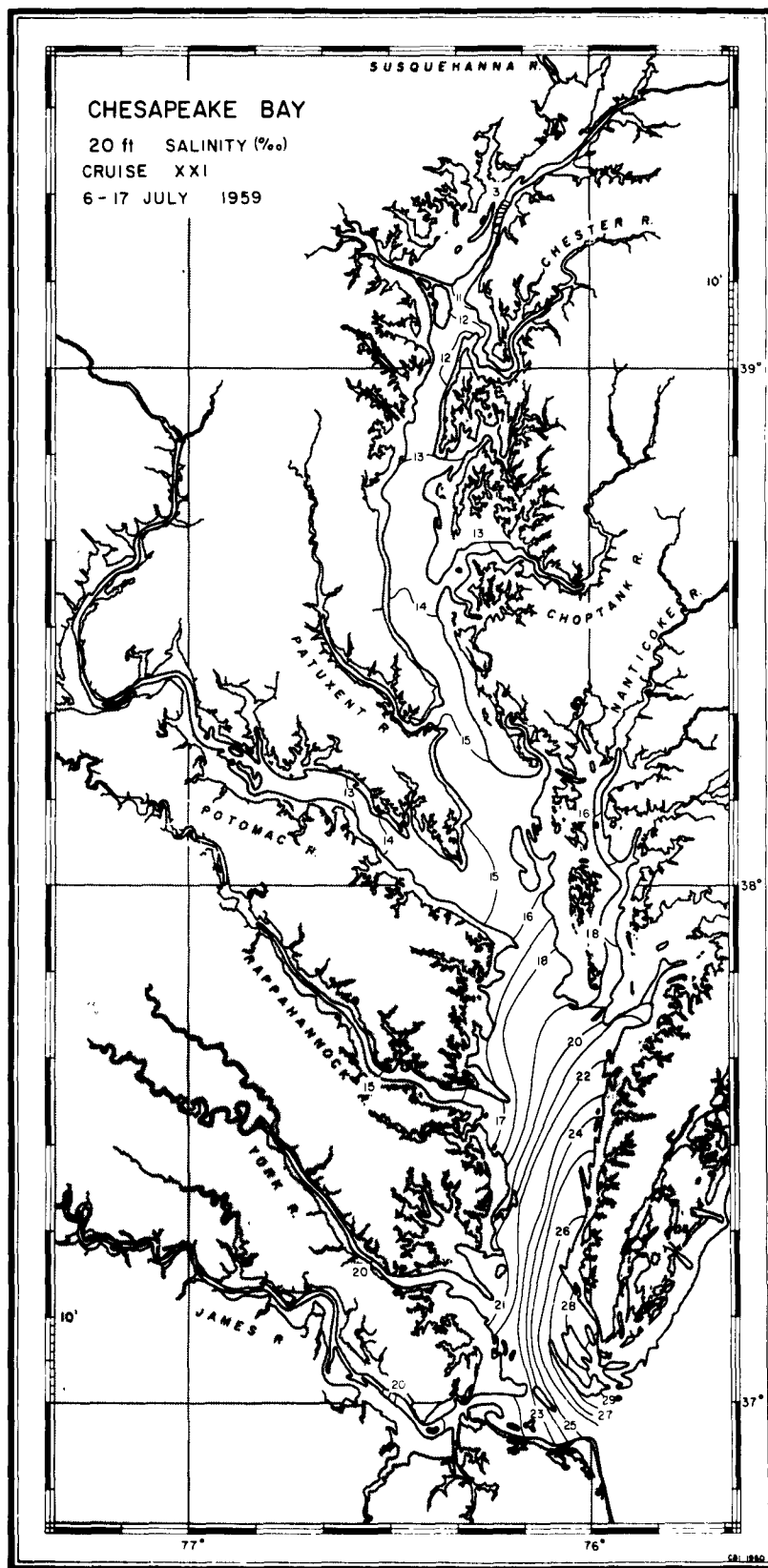


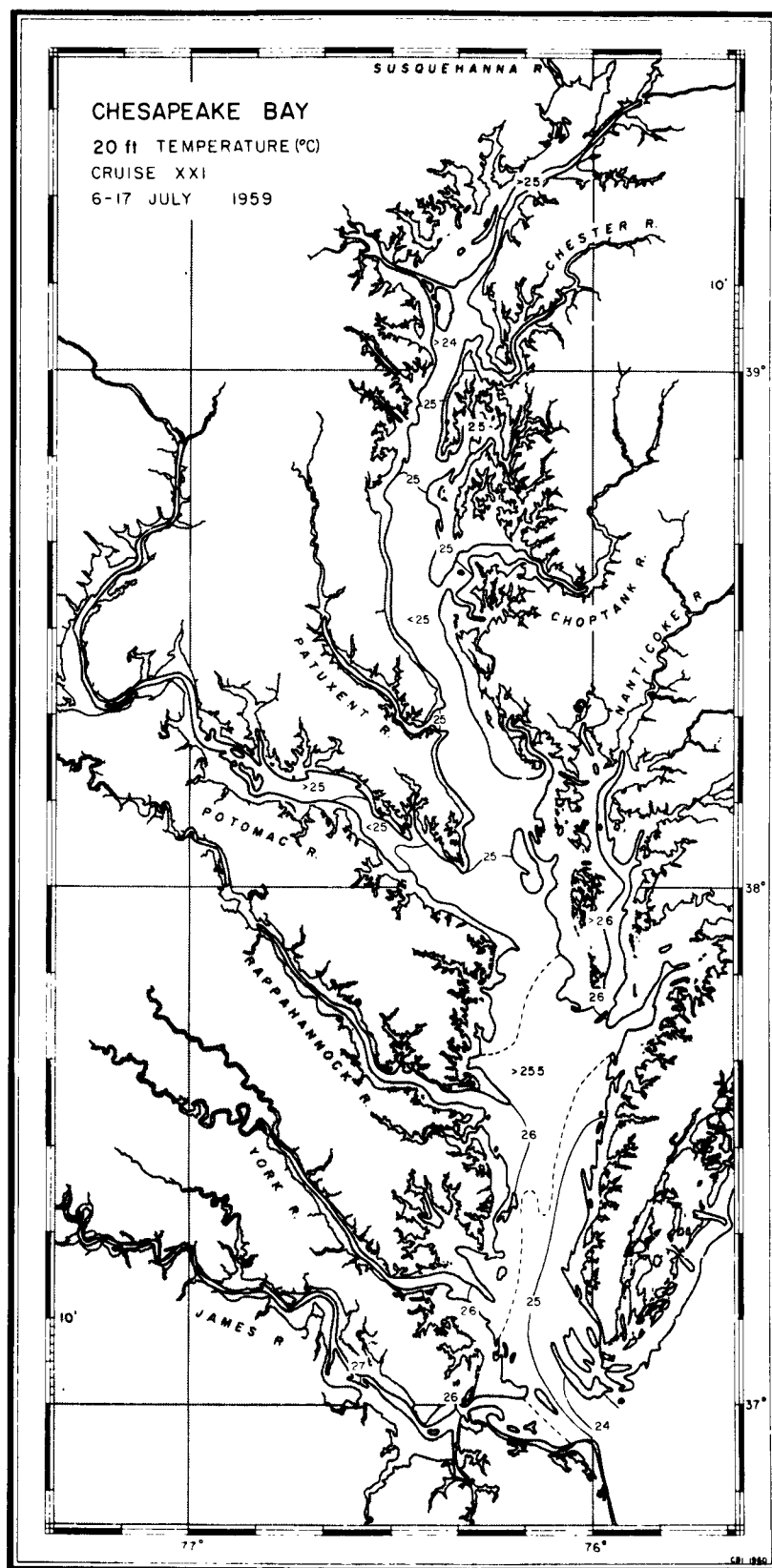


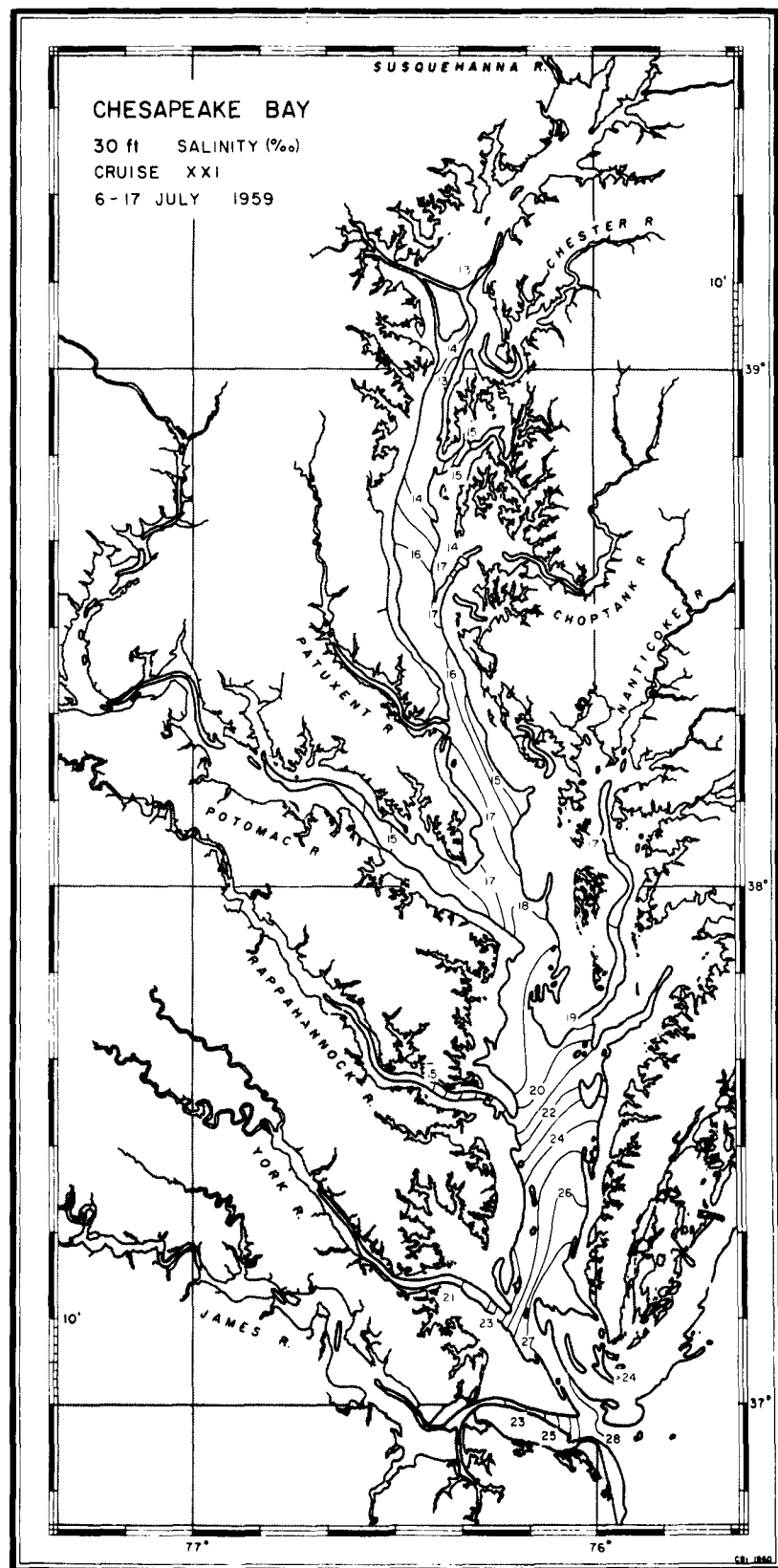


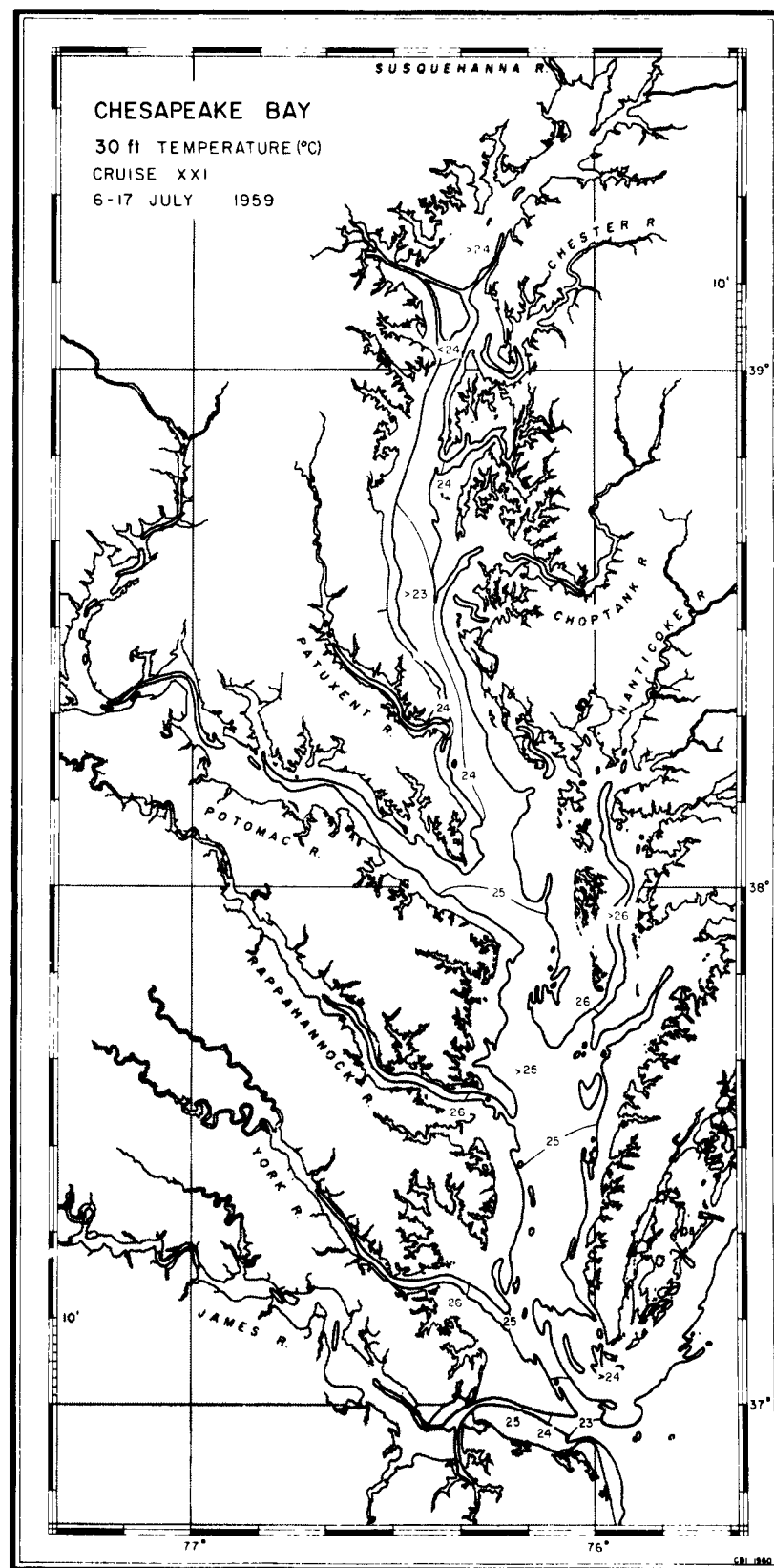


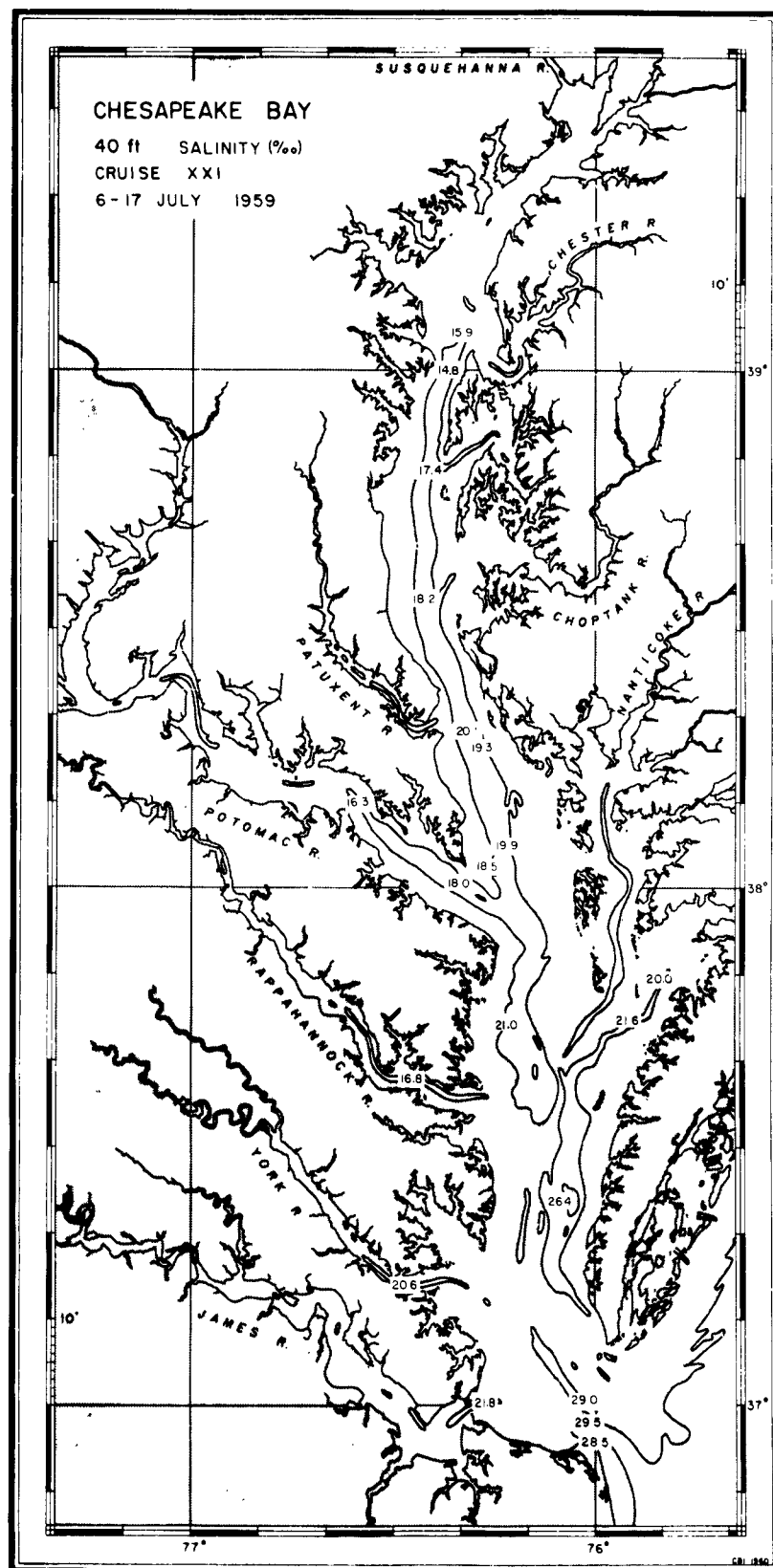


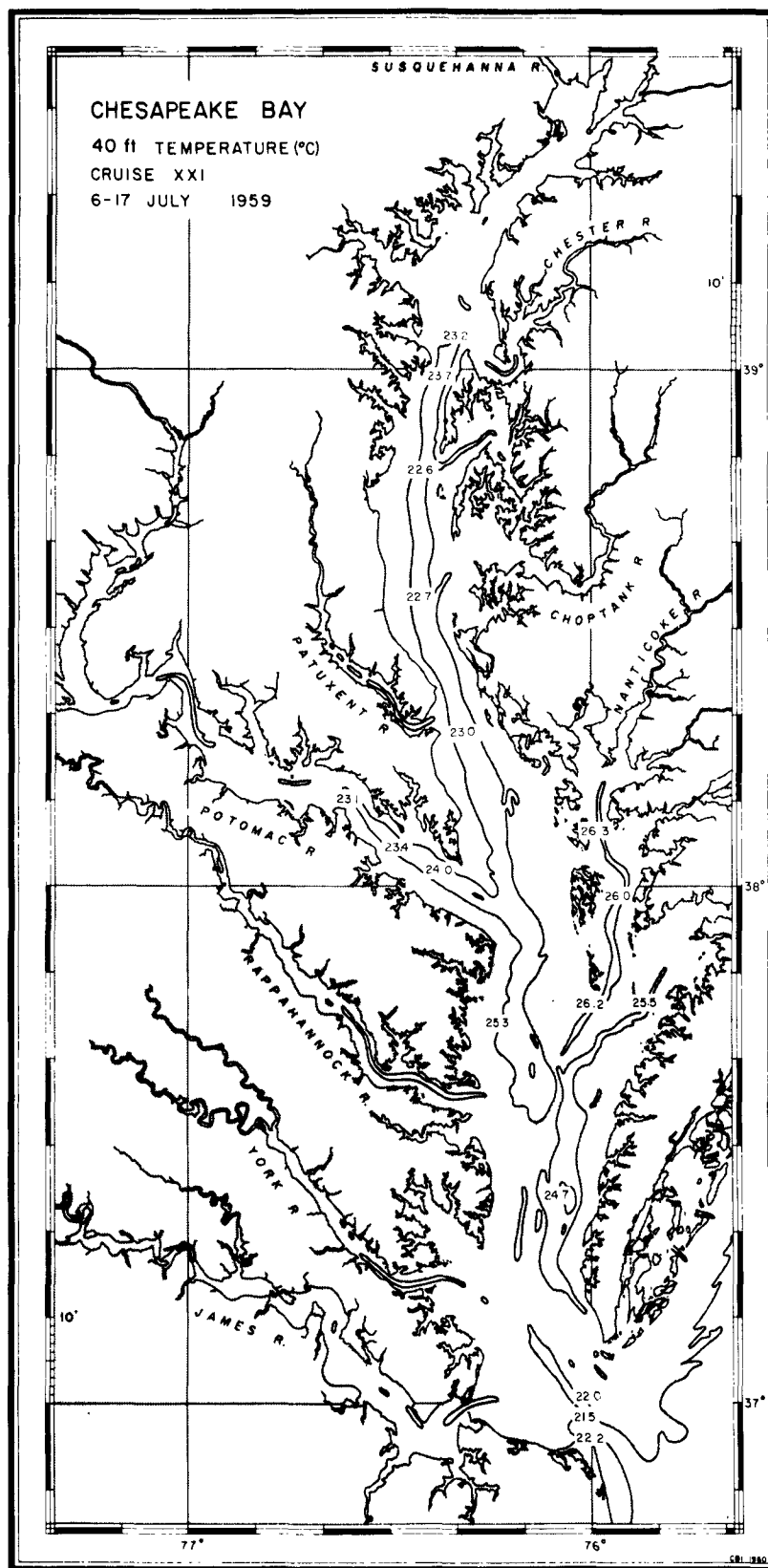


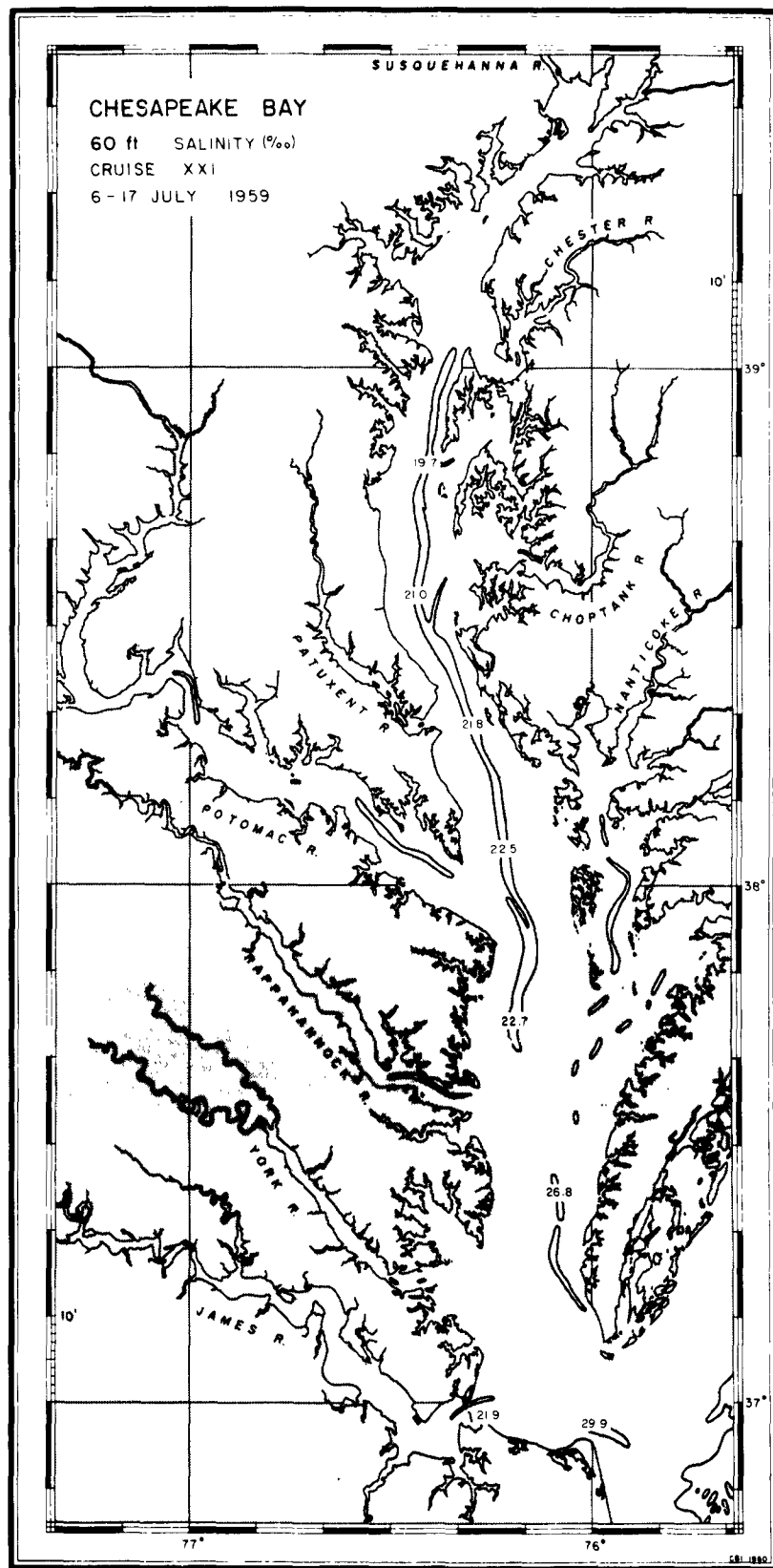


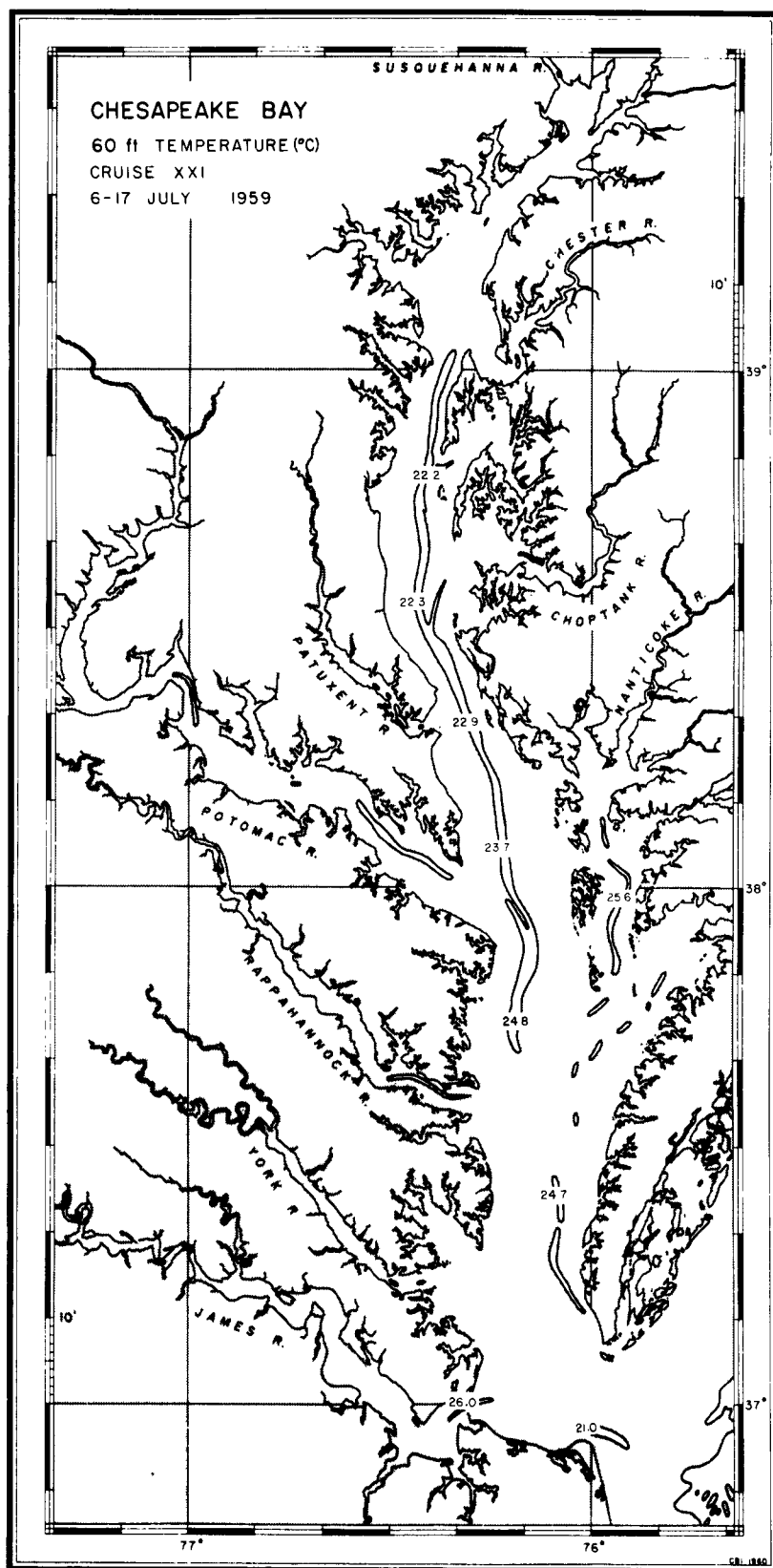




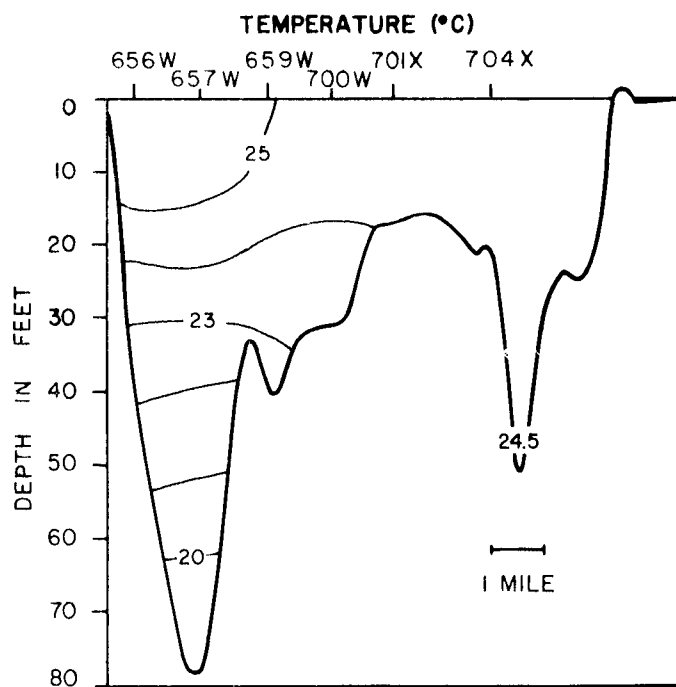
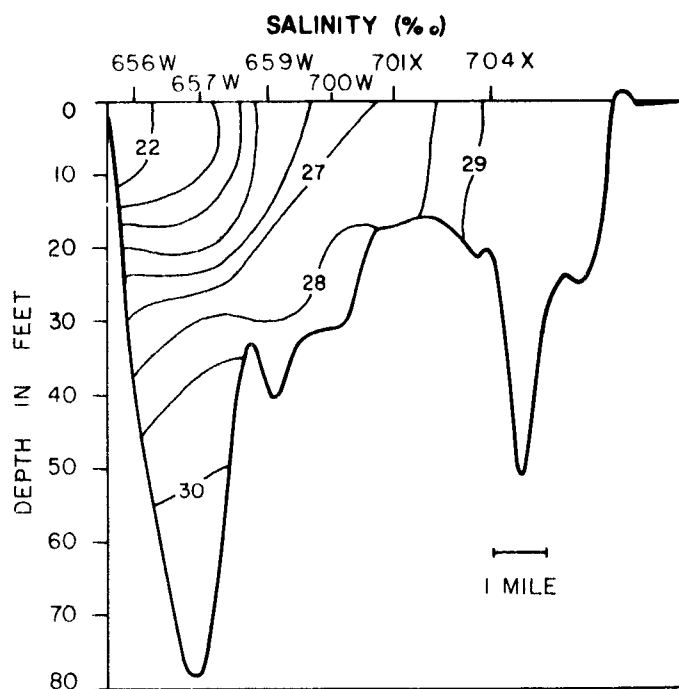




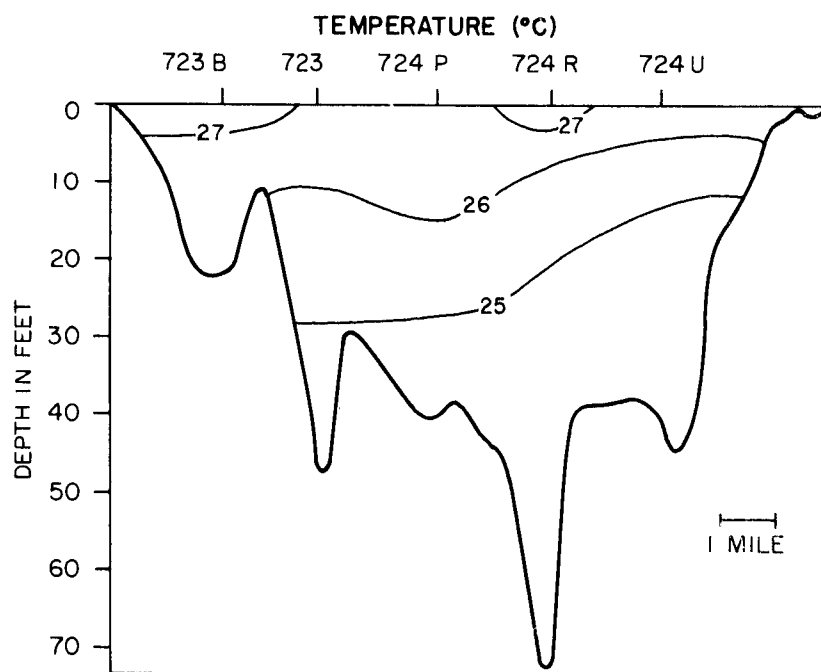
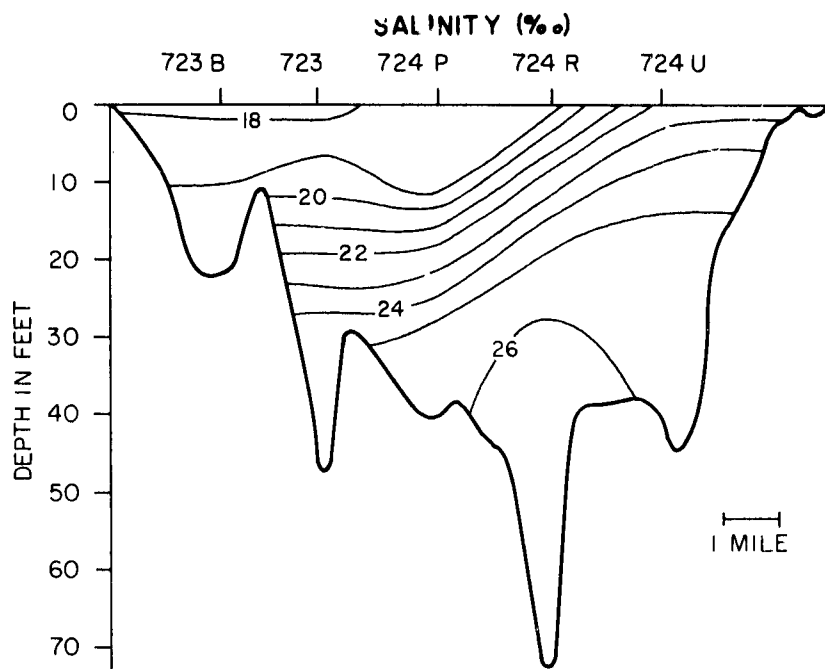




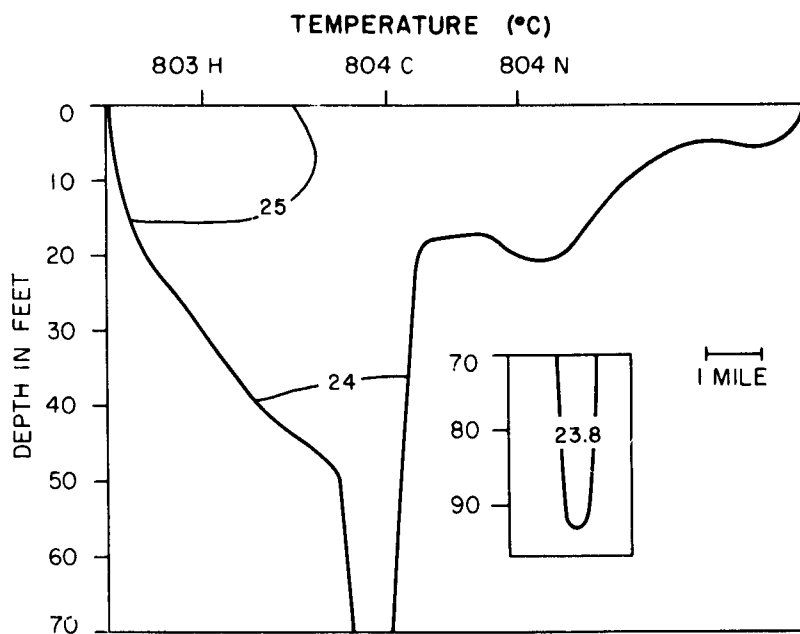
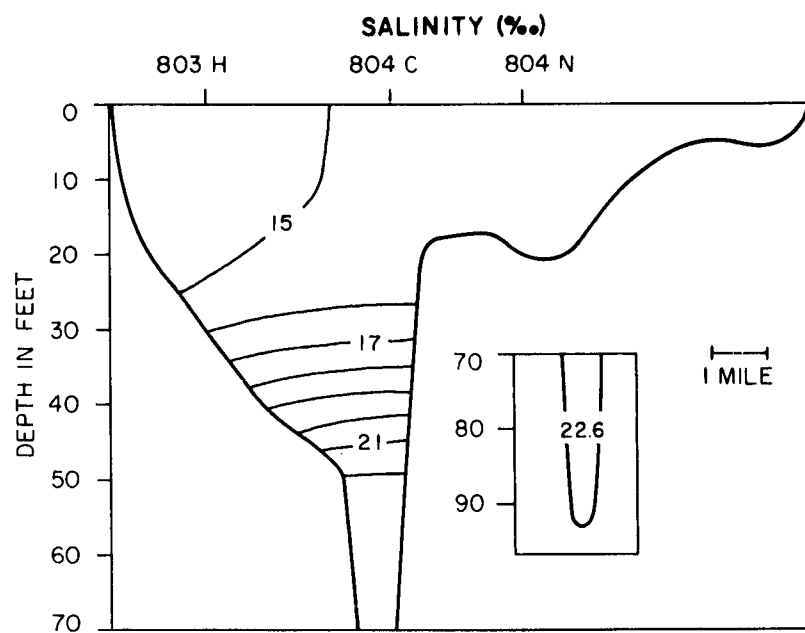
CRUISE XXI 6 - 17 JULY 1959 SECTION II



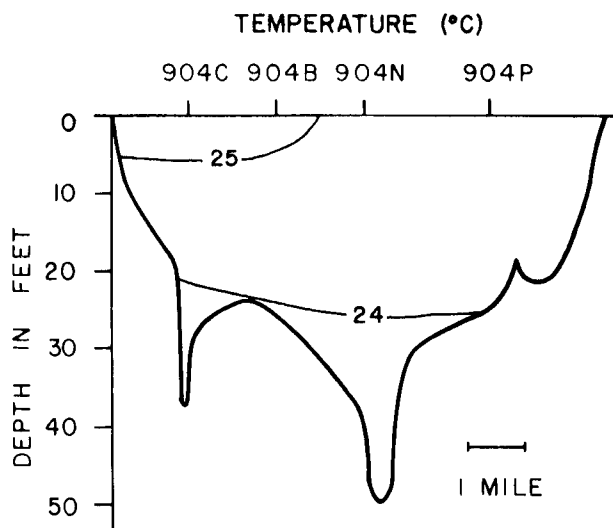
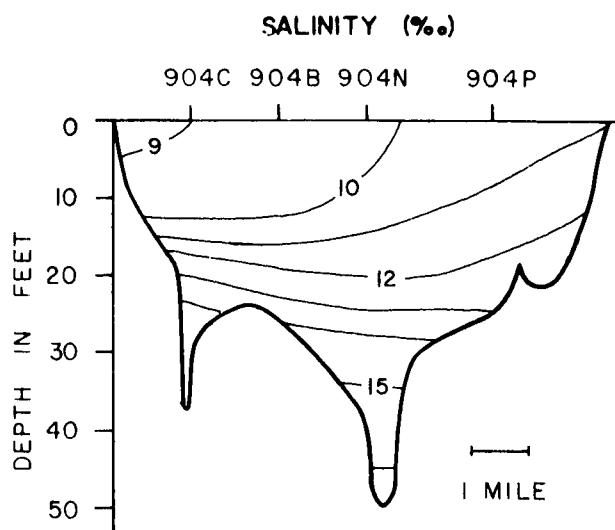
CRUISE XXI 6 - 17 JULY 1959 SECTION IV



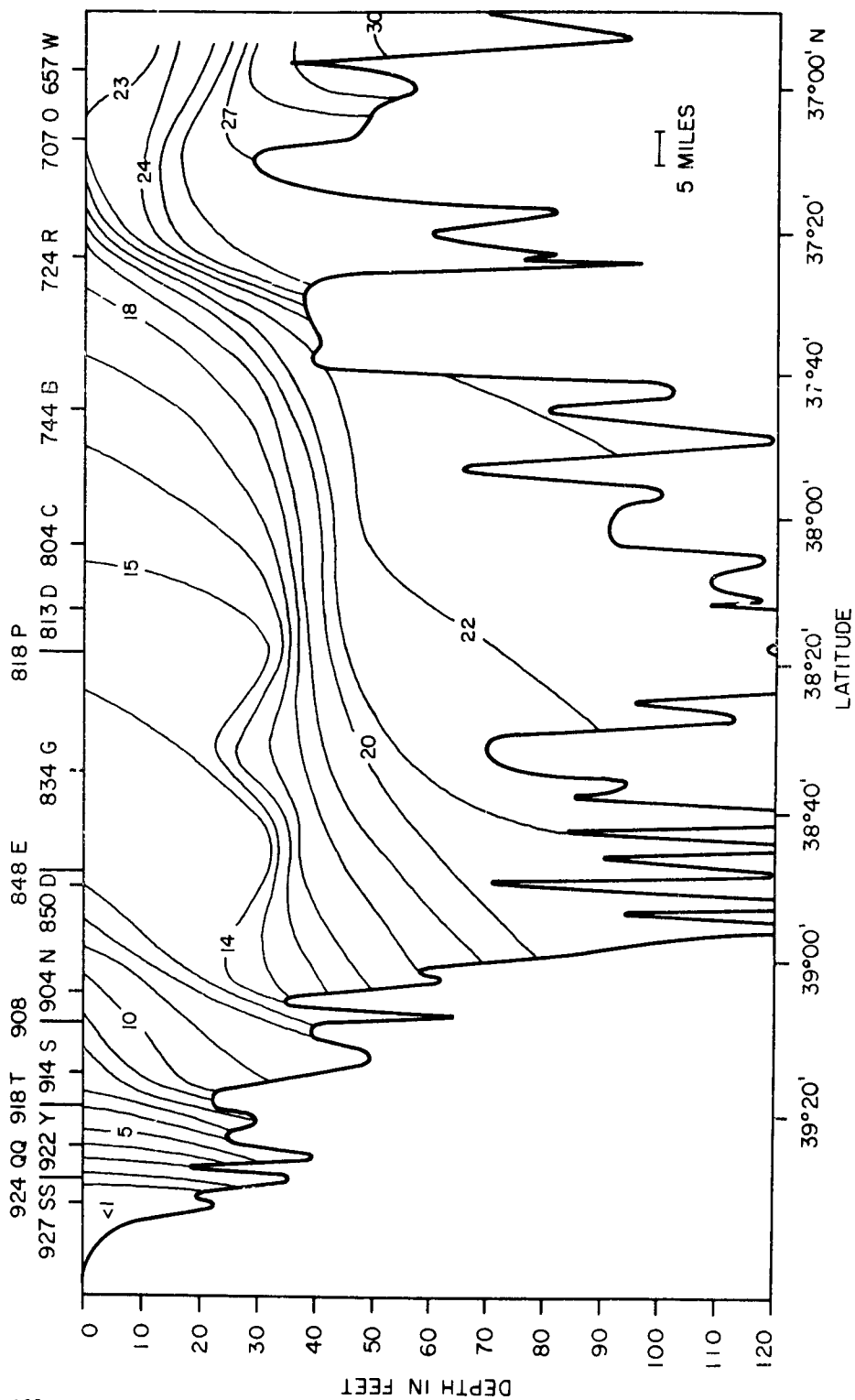
CRUISE XXI 6 - 17 JULY 1959 SECTION VI



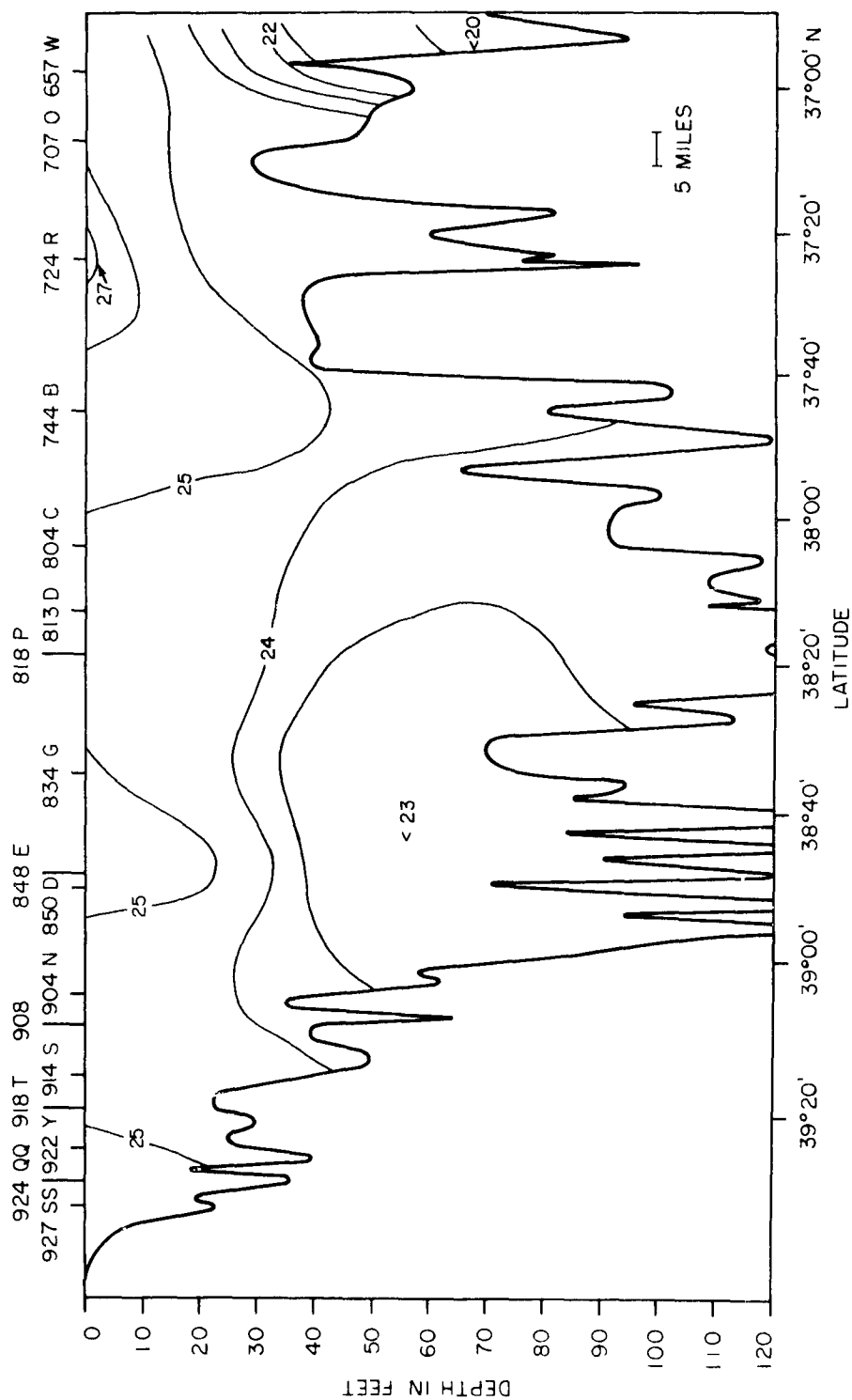
CRUISE XXI 6 - 17 JULY 1959 SECTION X

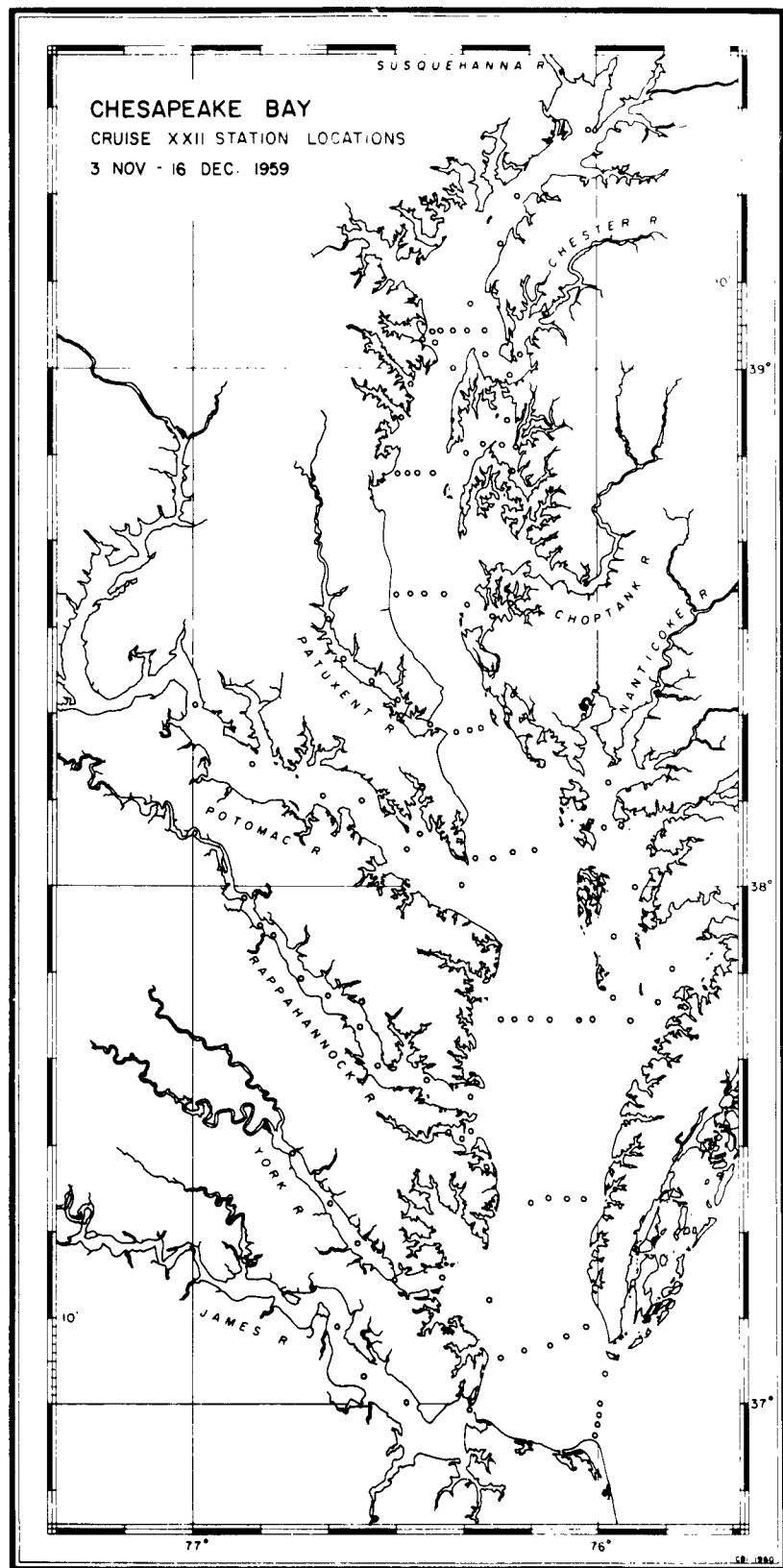


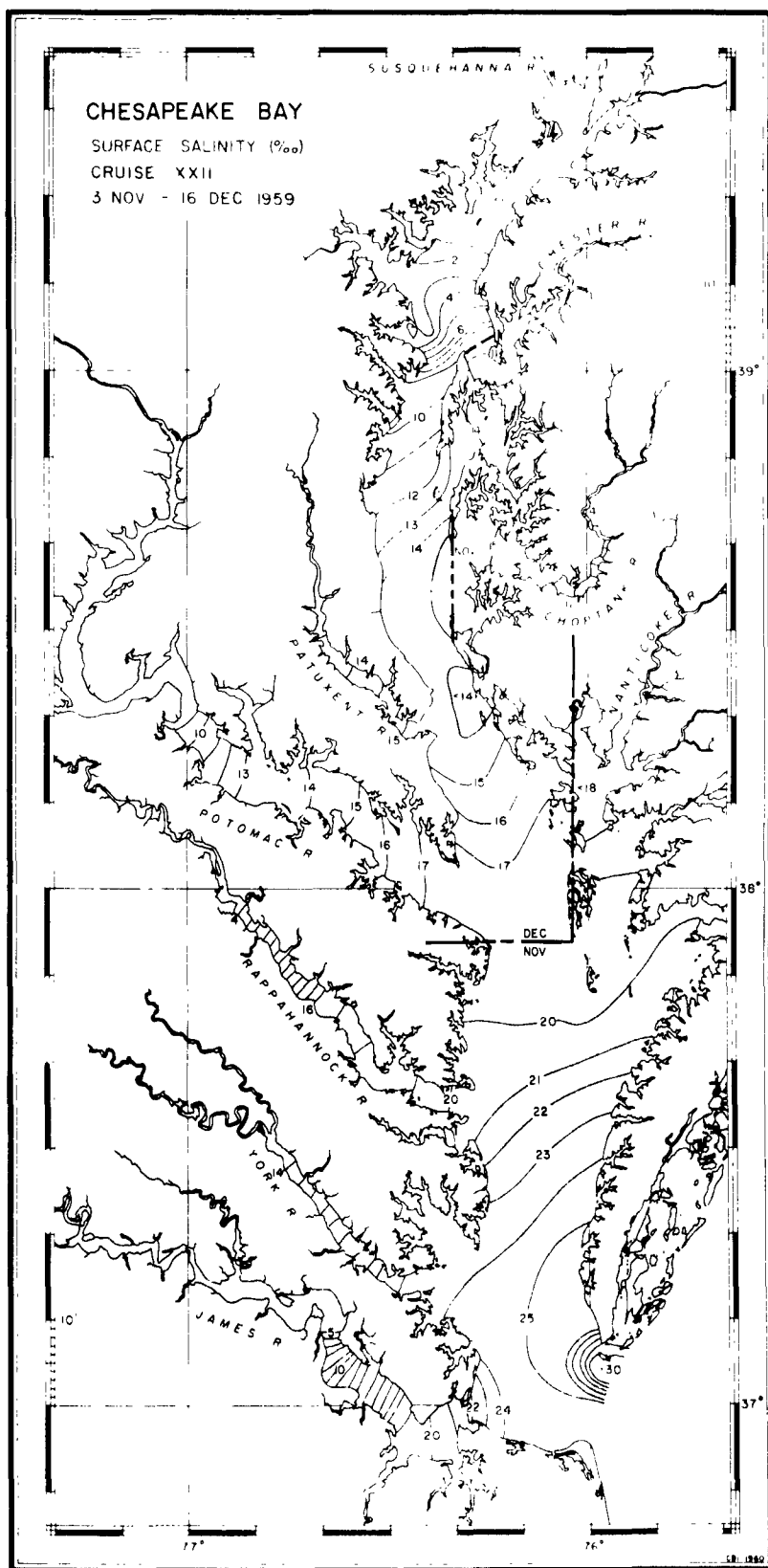
CRUISE XXI 6 - 17 JULY 1959 SECTION XIX
SALINITY (‰)

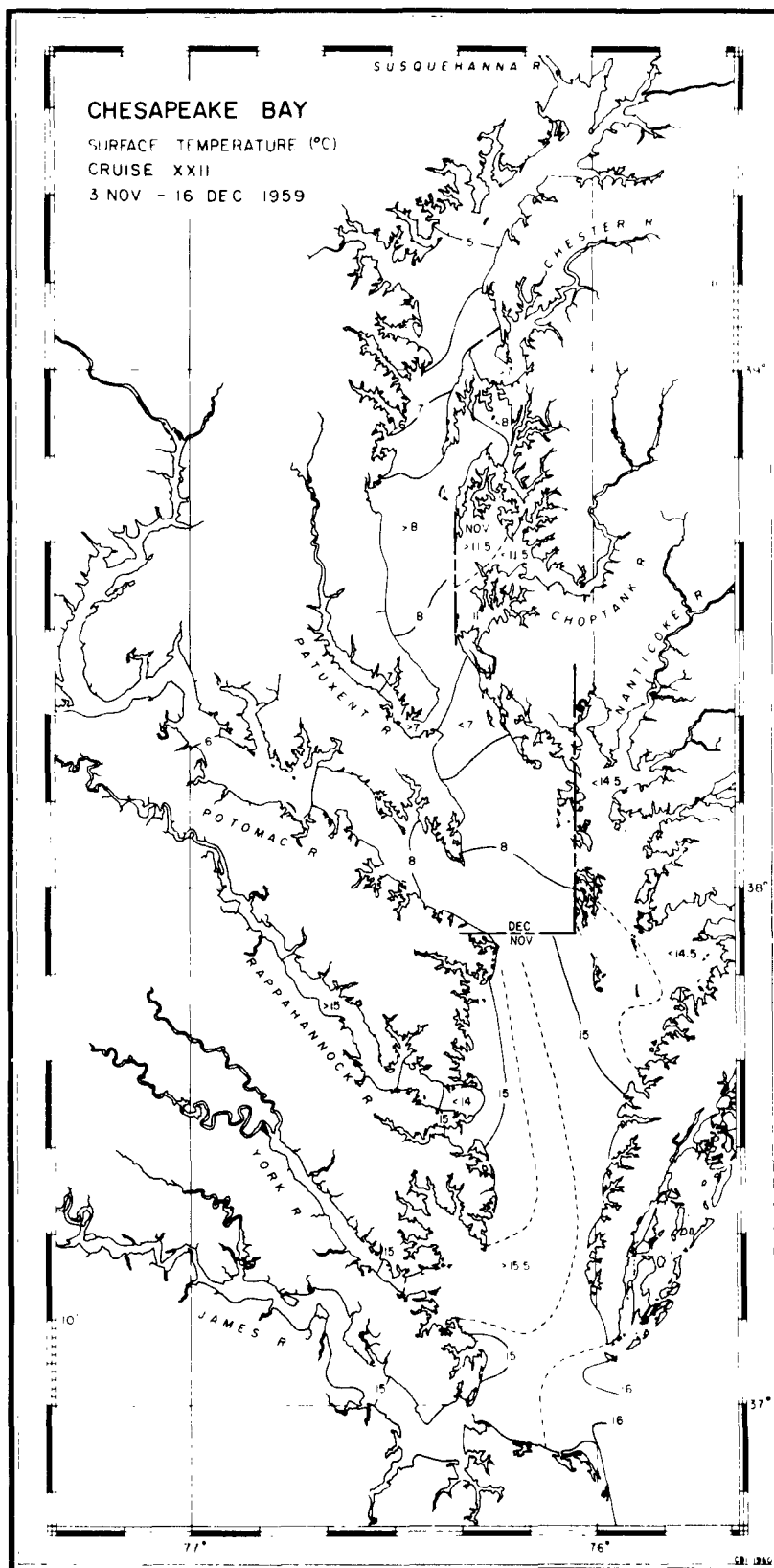


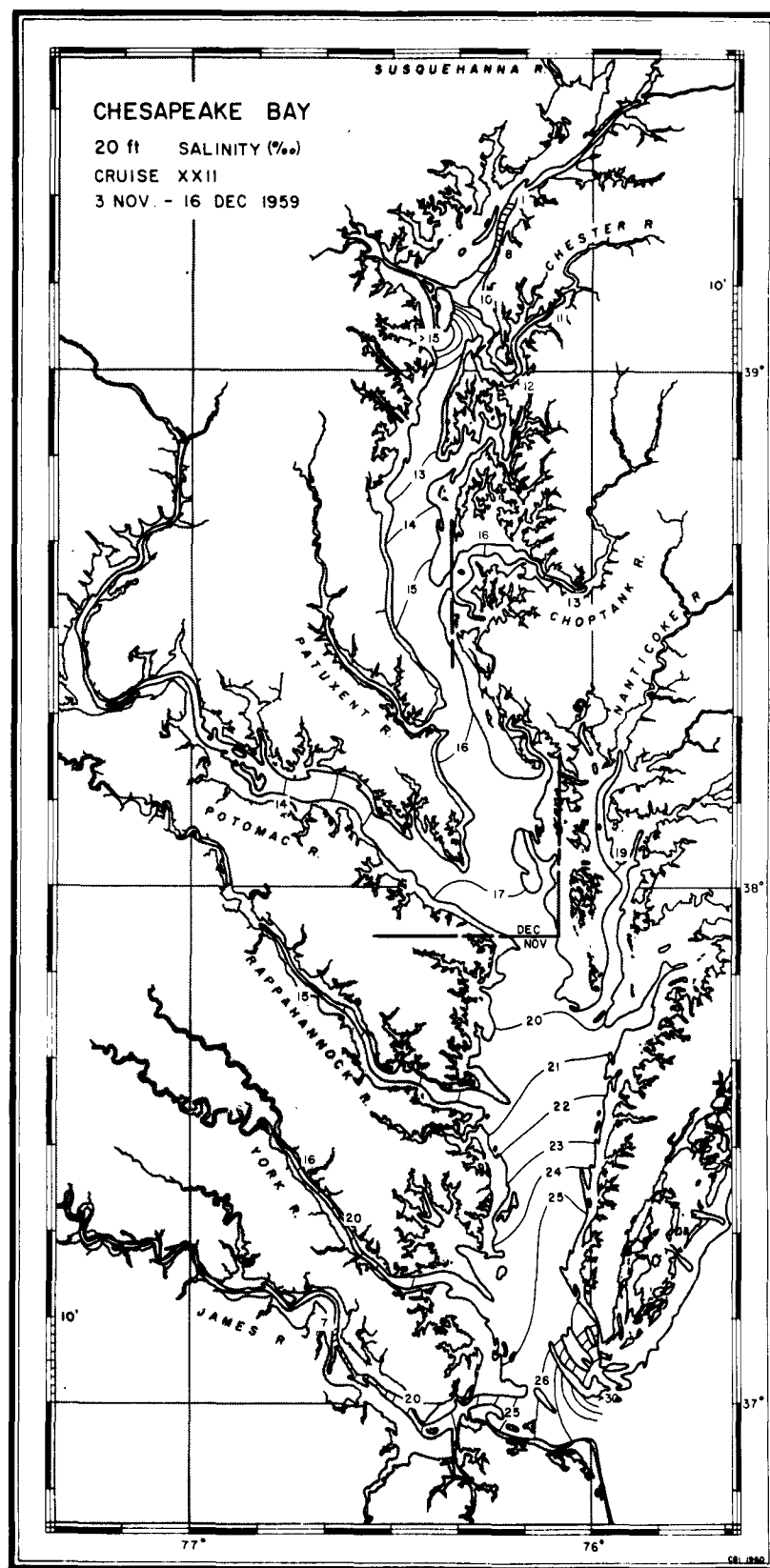
CRUISE XXI 6 - 17 JULY 1959 SECTION XIX
TEMPERATURE (°C)

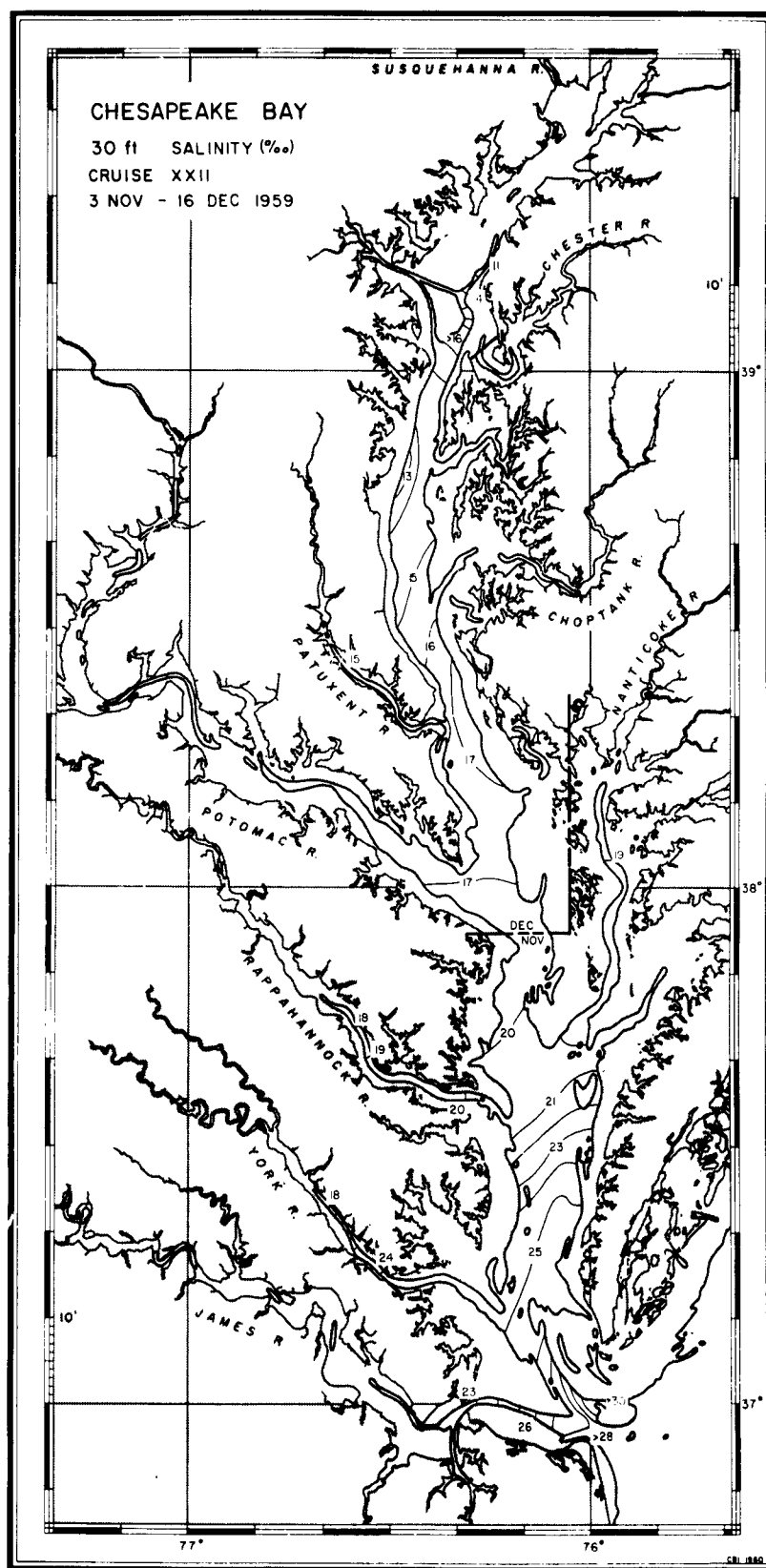


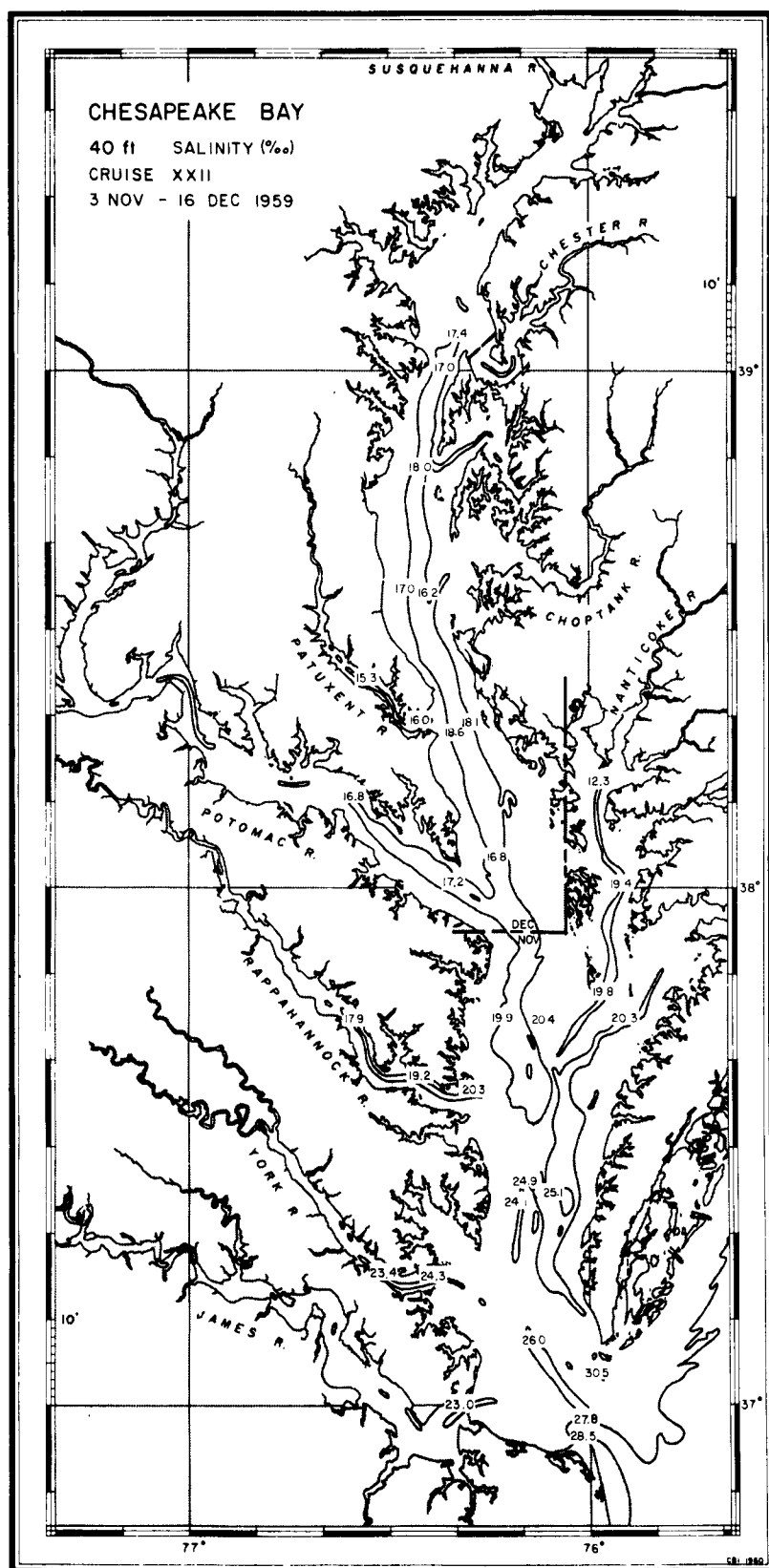


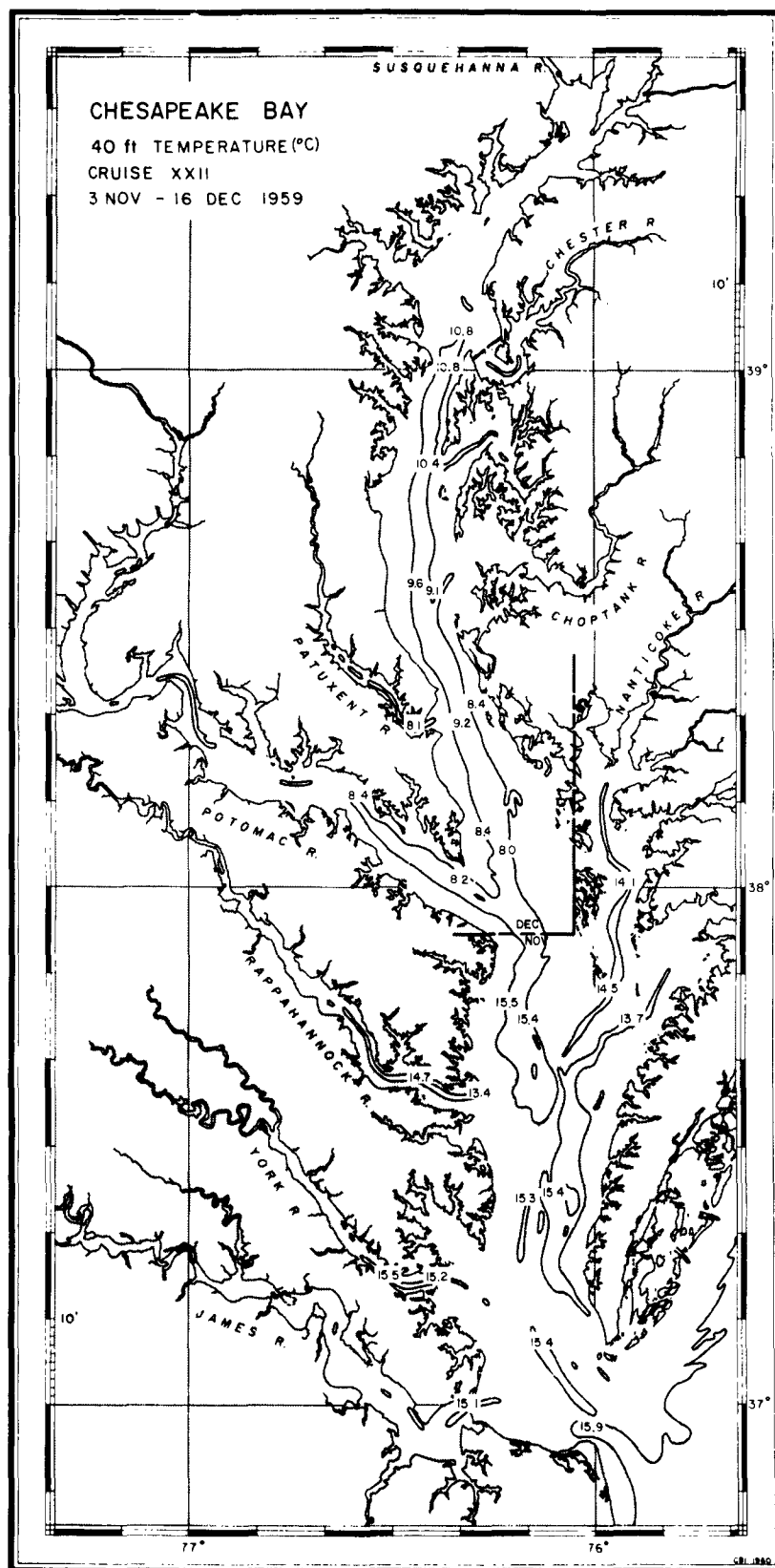


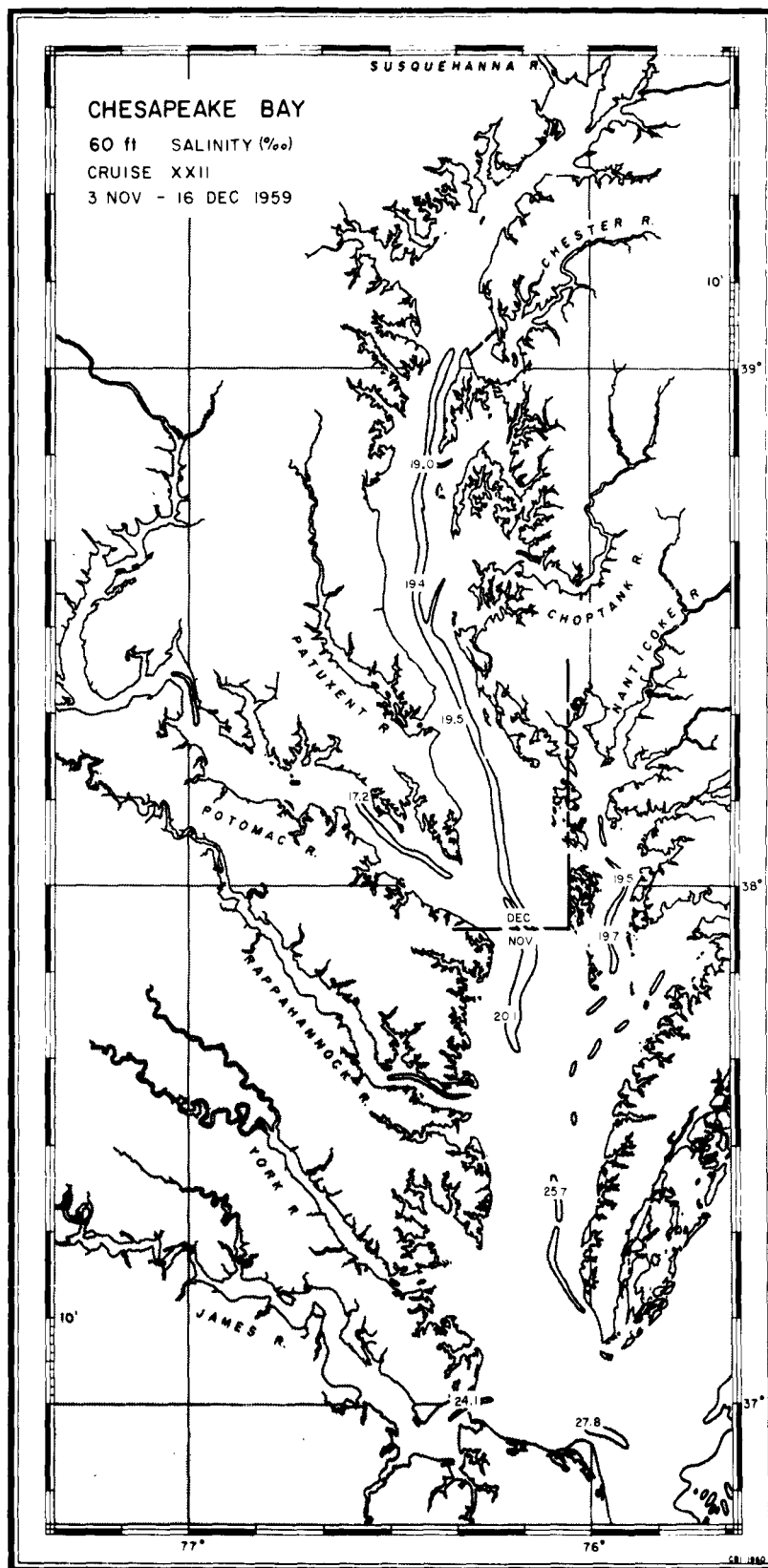


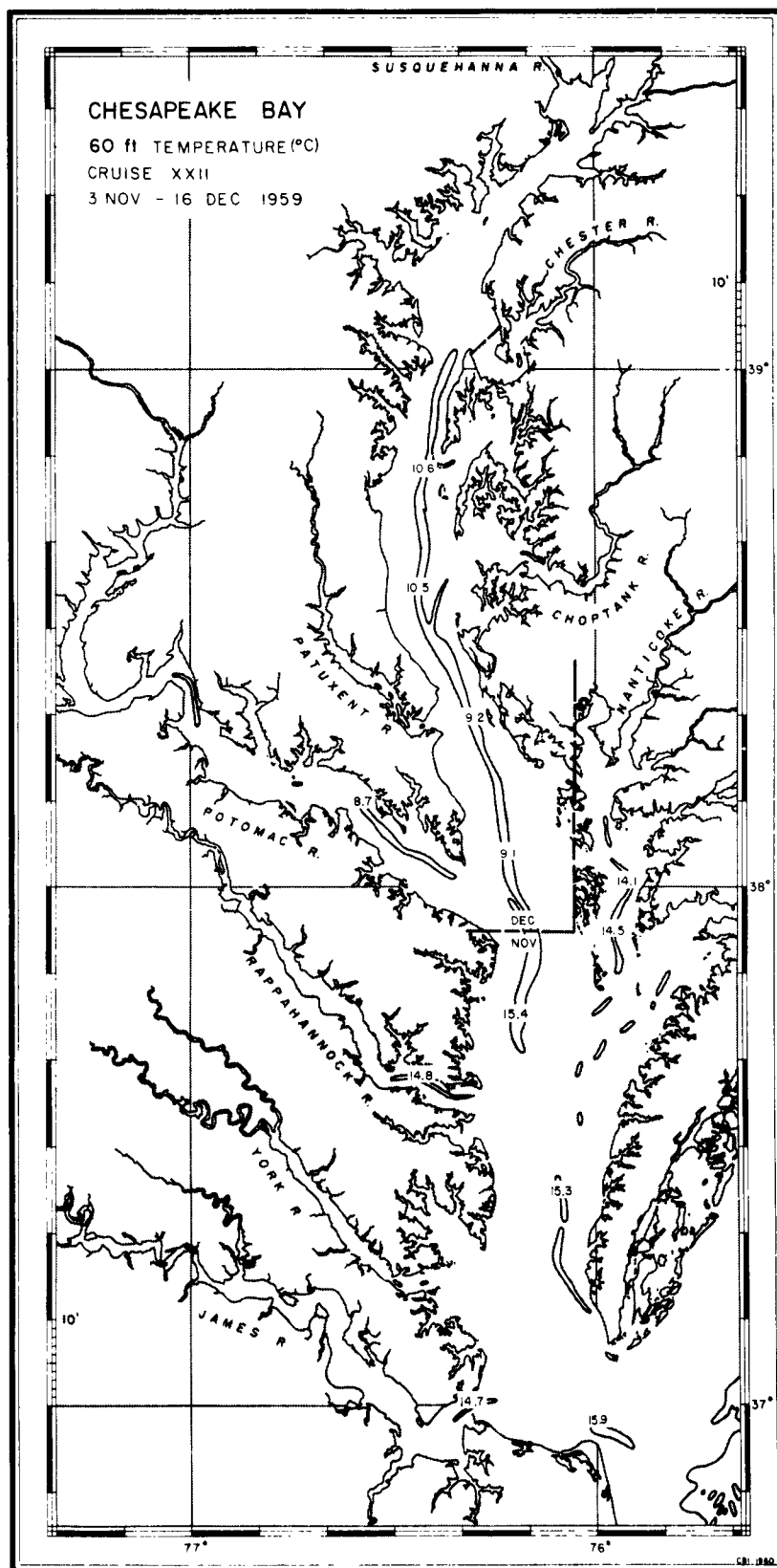




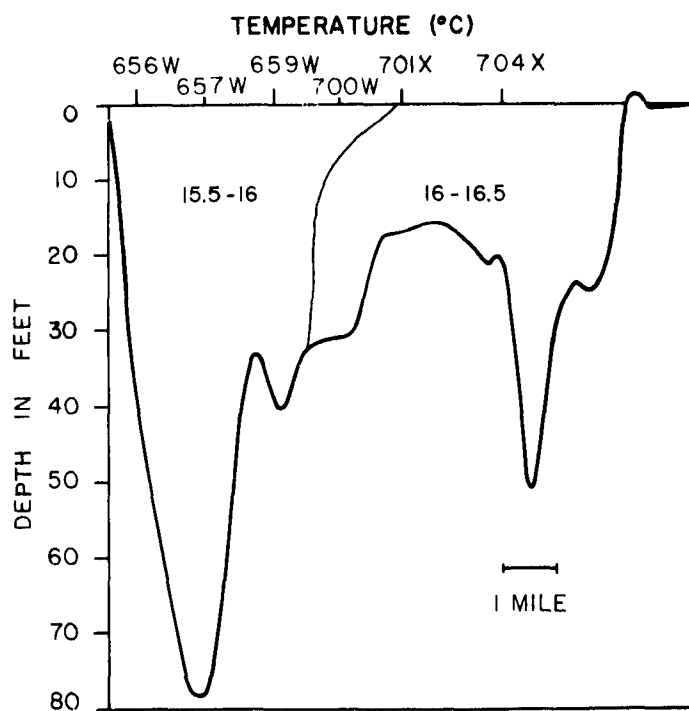
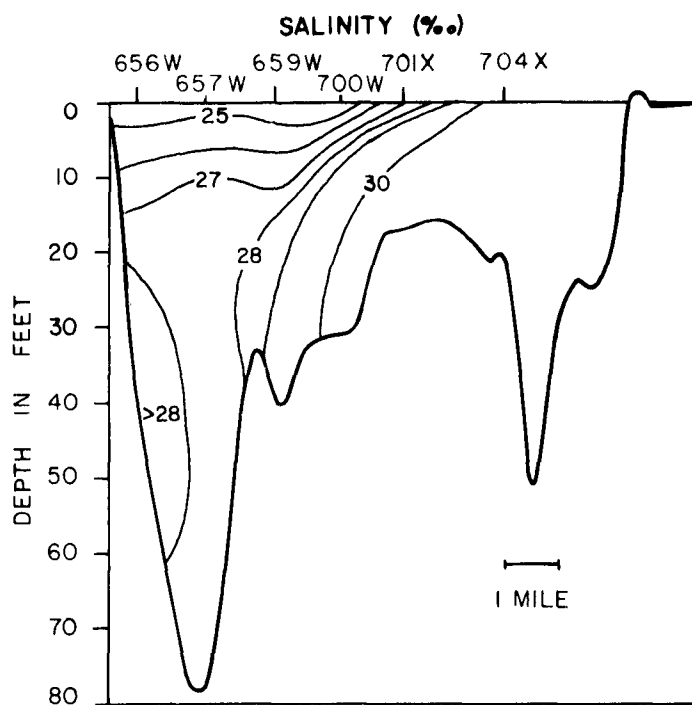




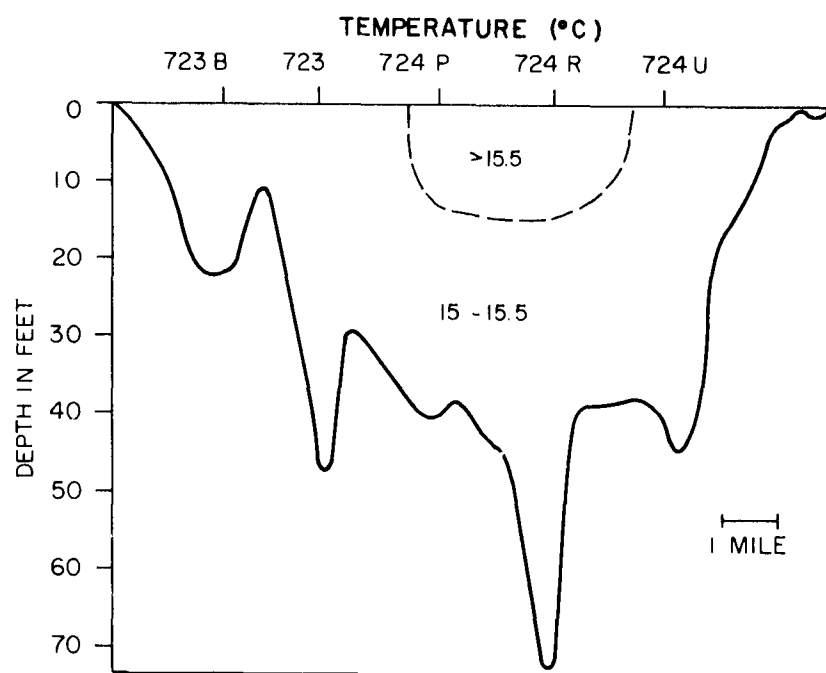
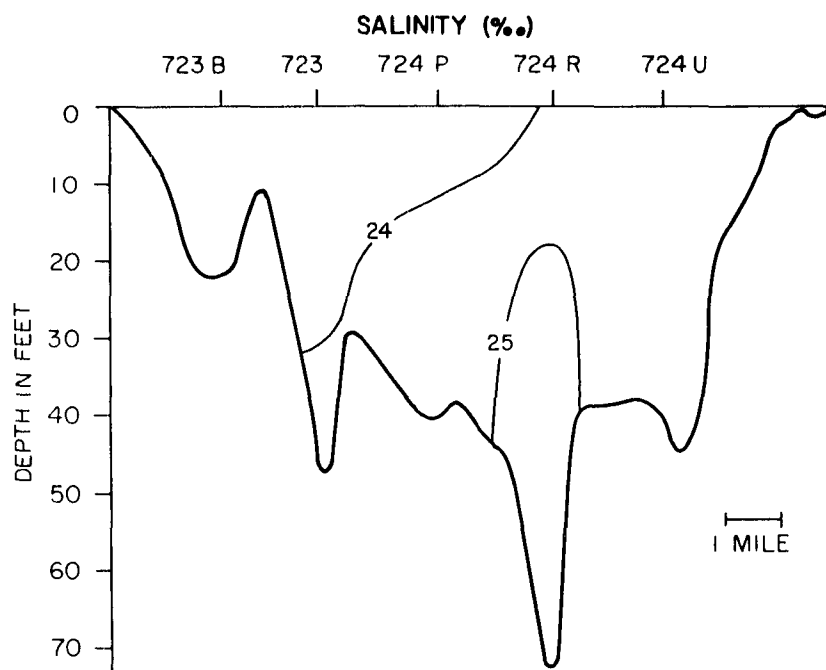




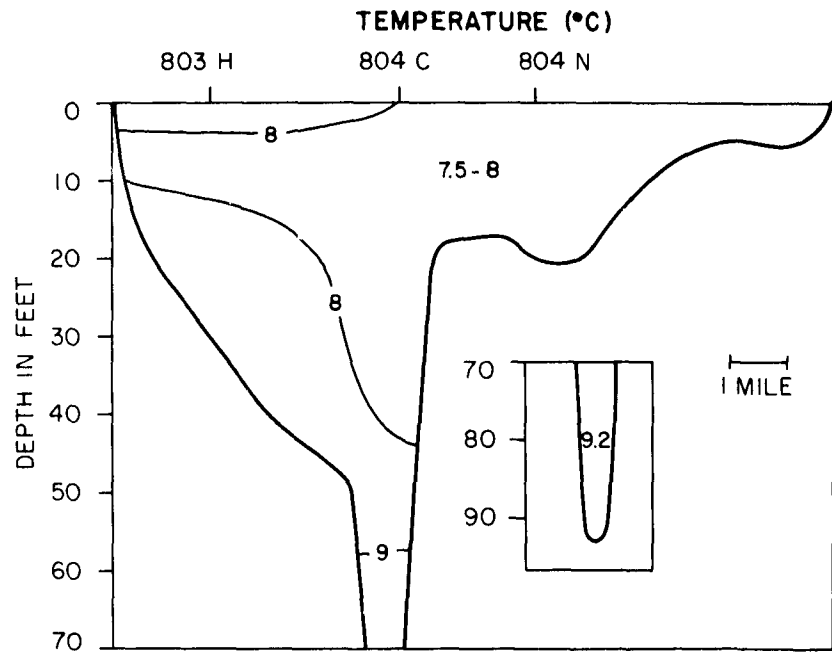
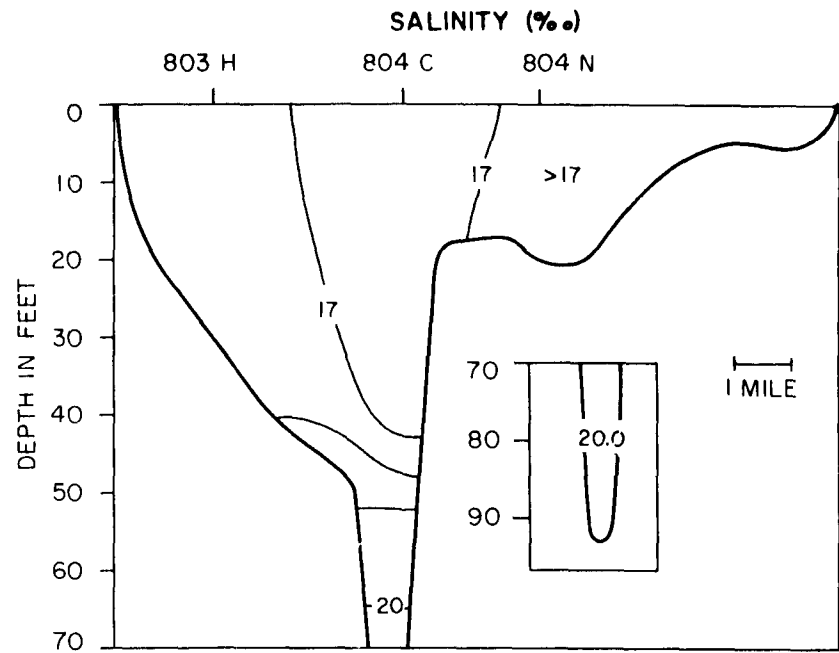
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION II



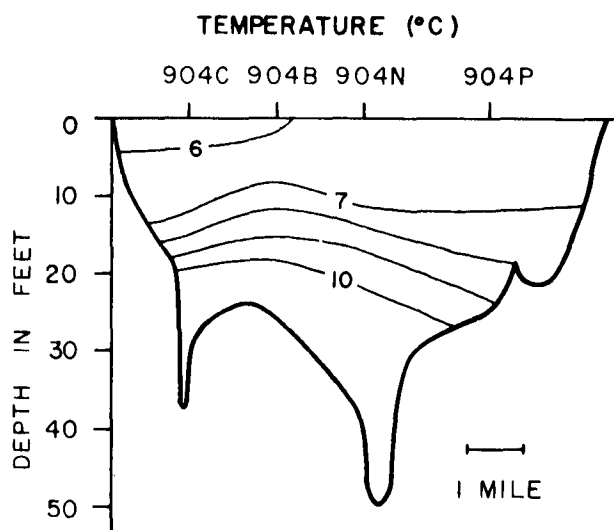
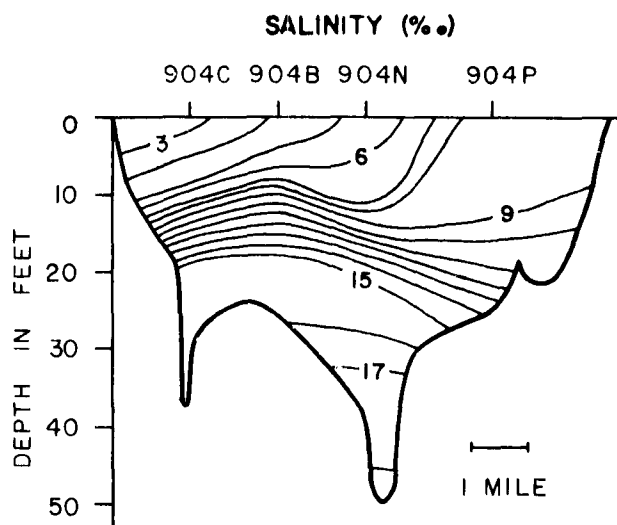
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION IV



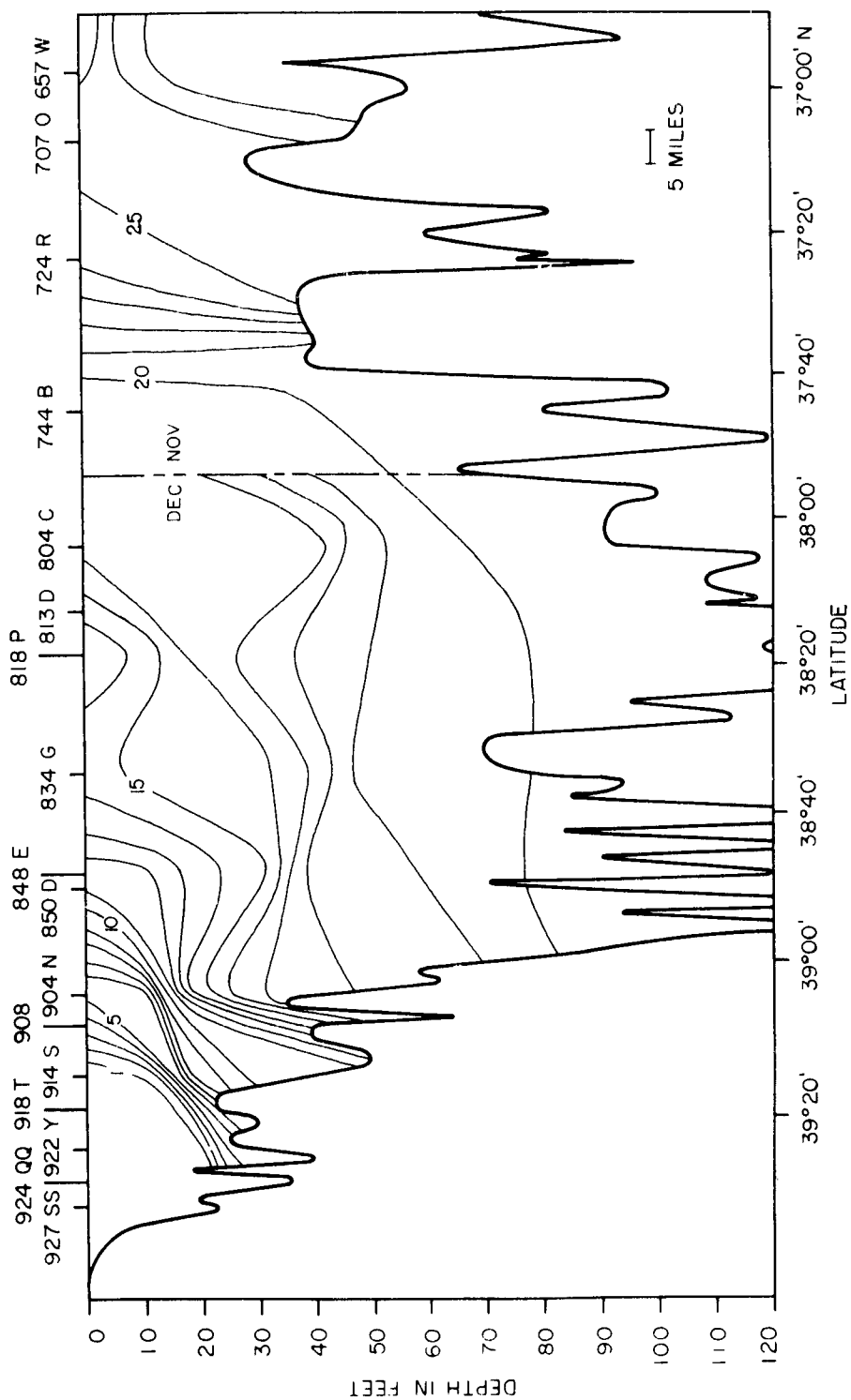
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION VI



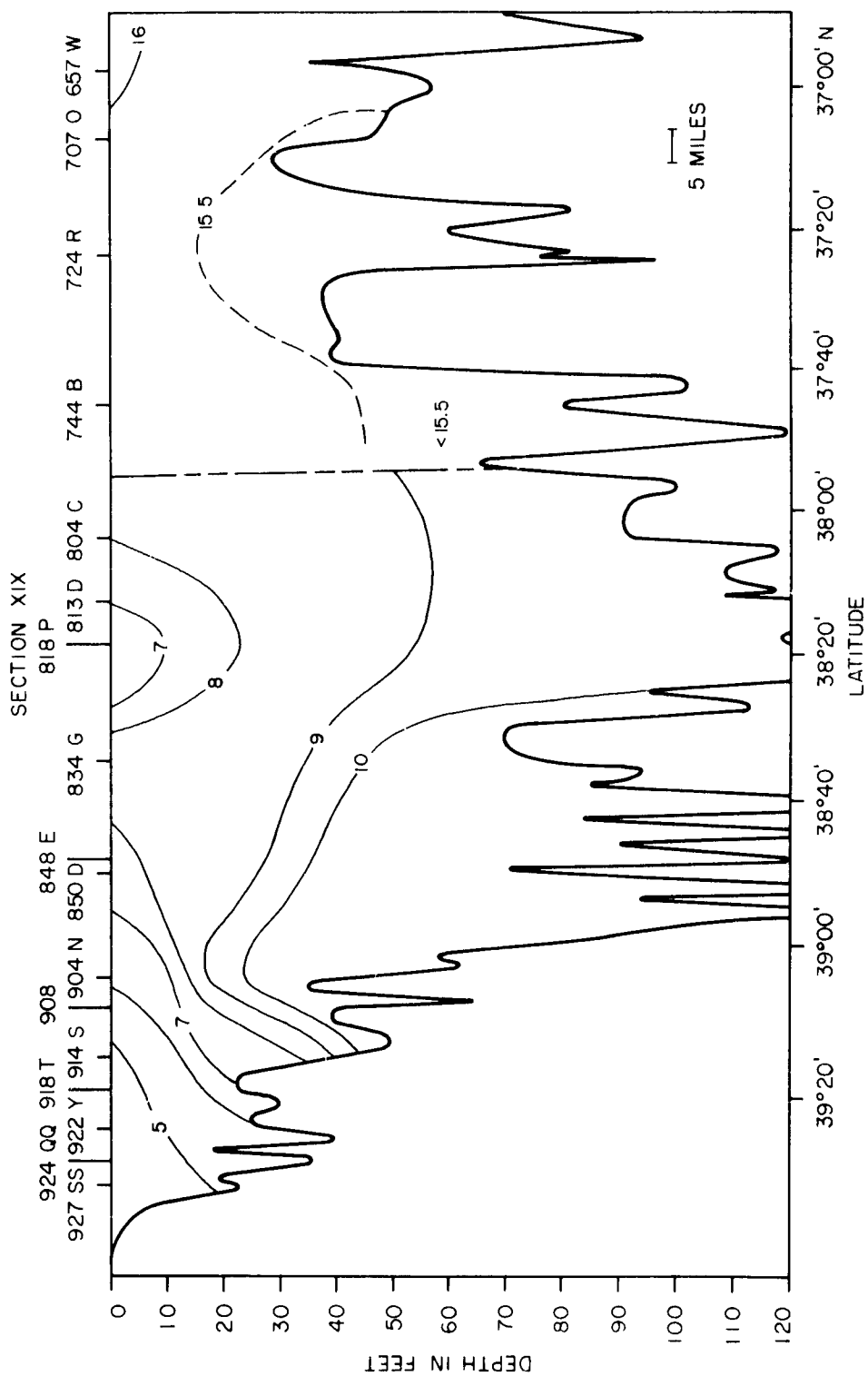
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION X

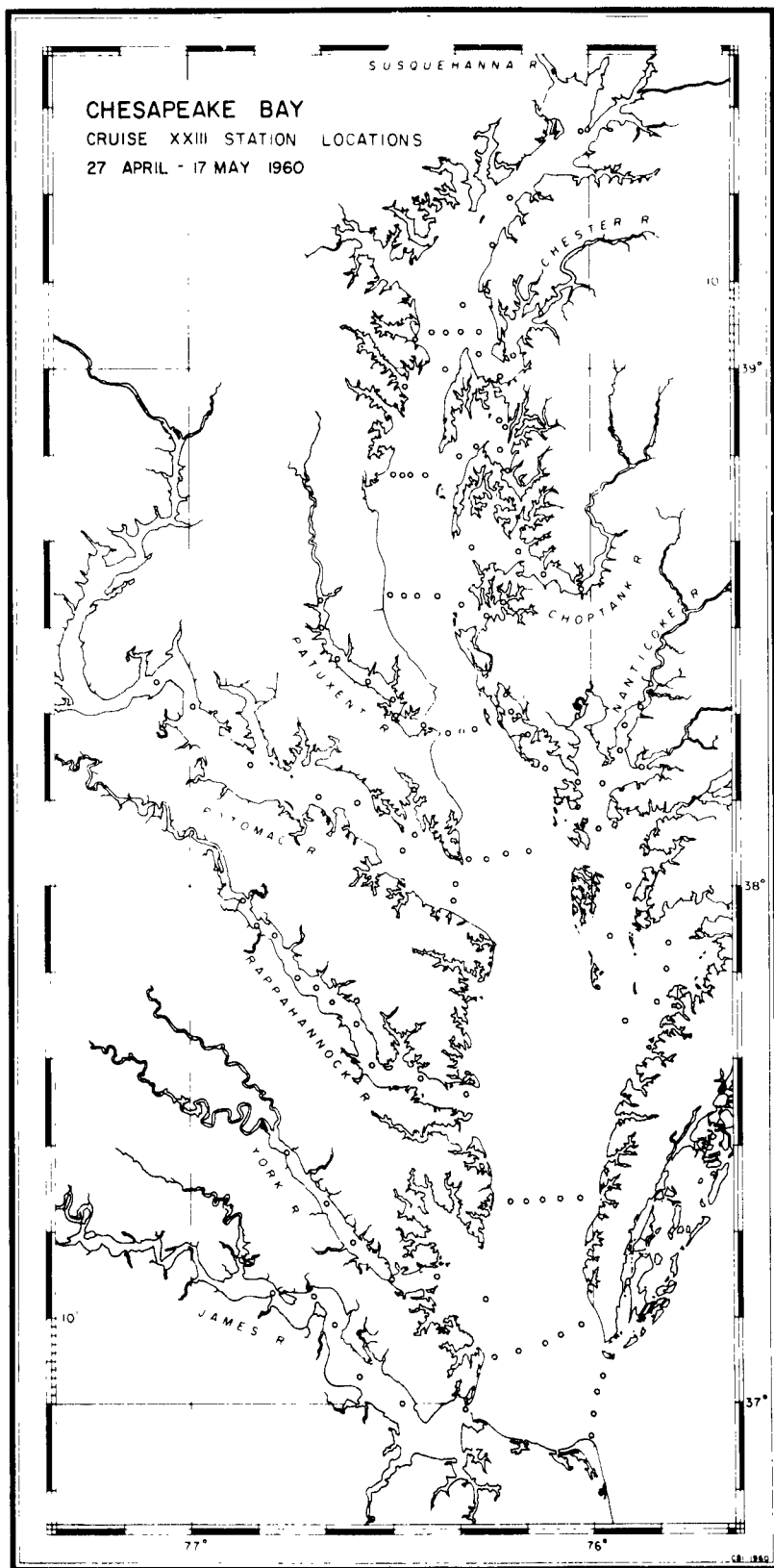


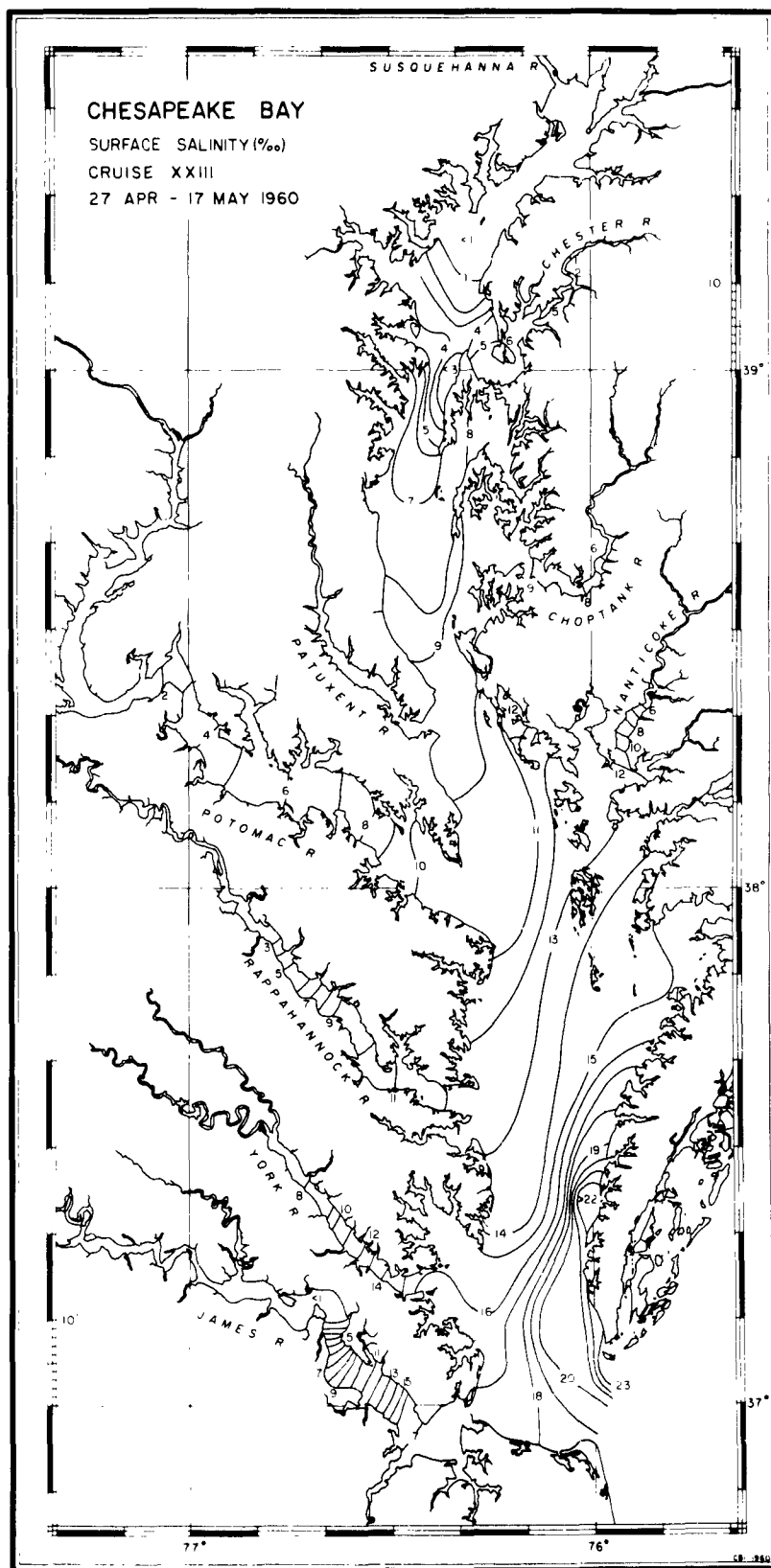
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION XIX
SALINITY (‰)

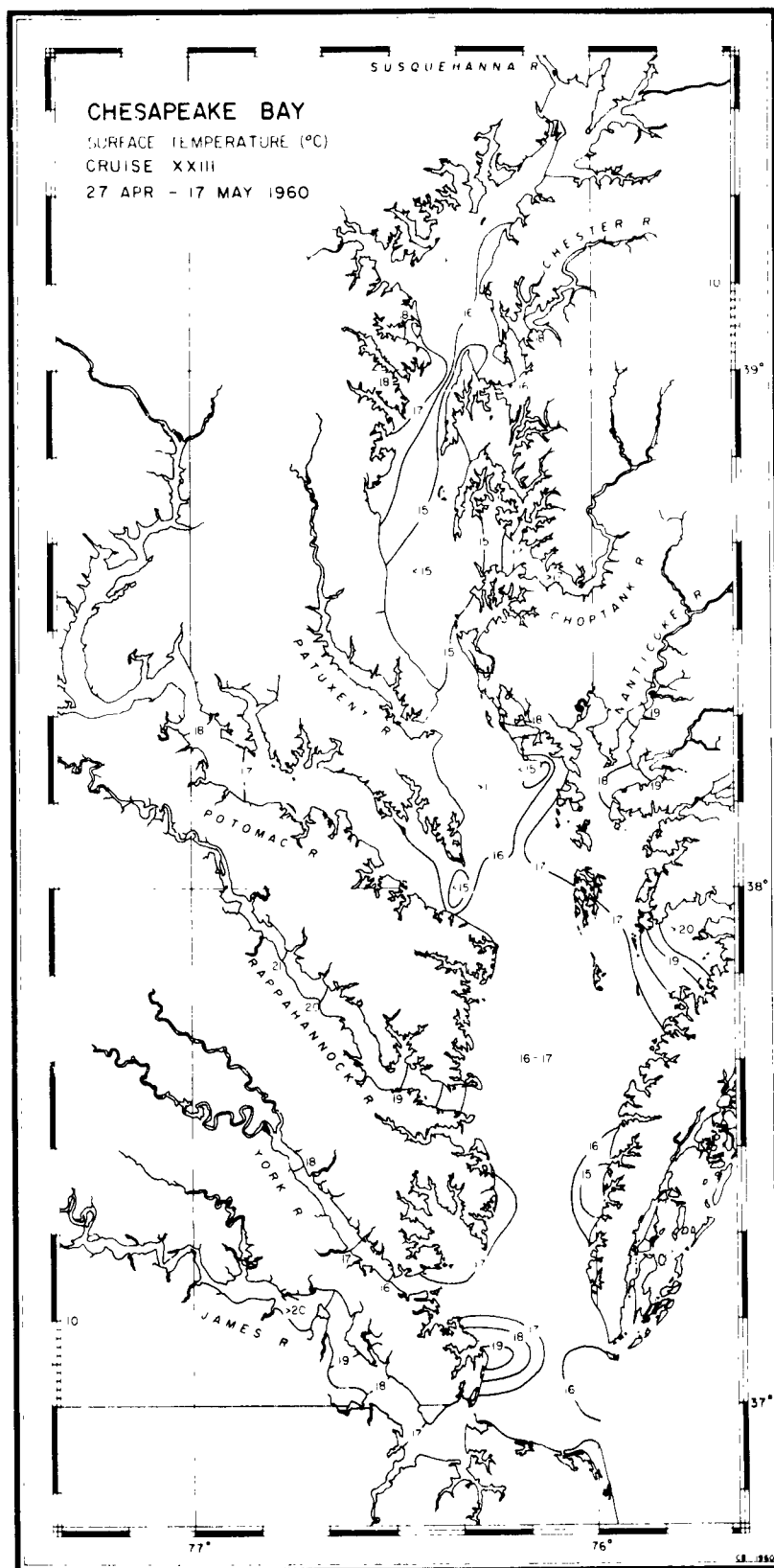


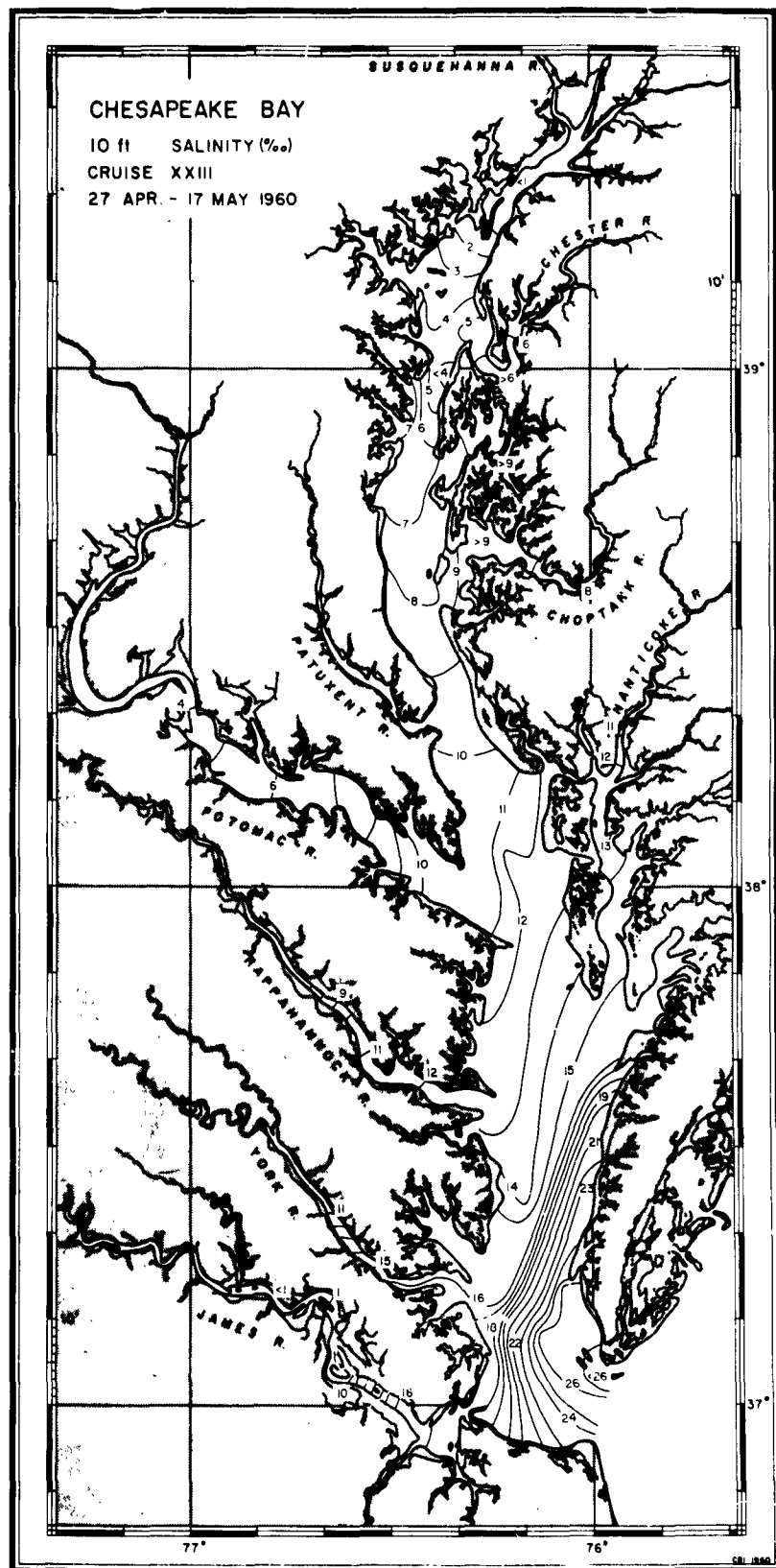
CRUISE XXII 3 NOV - 16 DEC 1959 SECTION XIX
TEMPERATURE (°C)

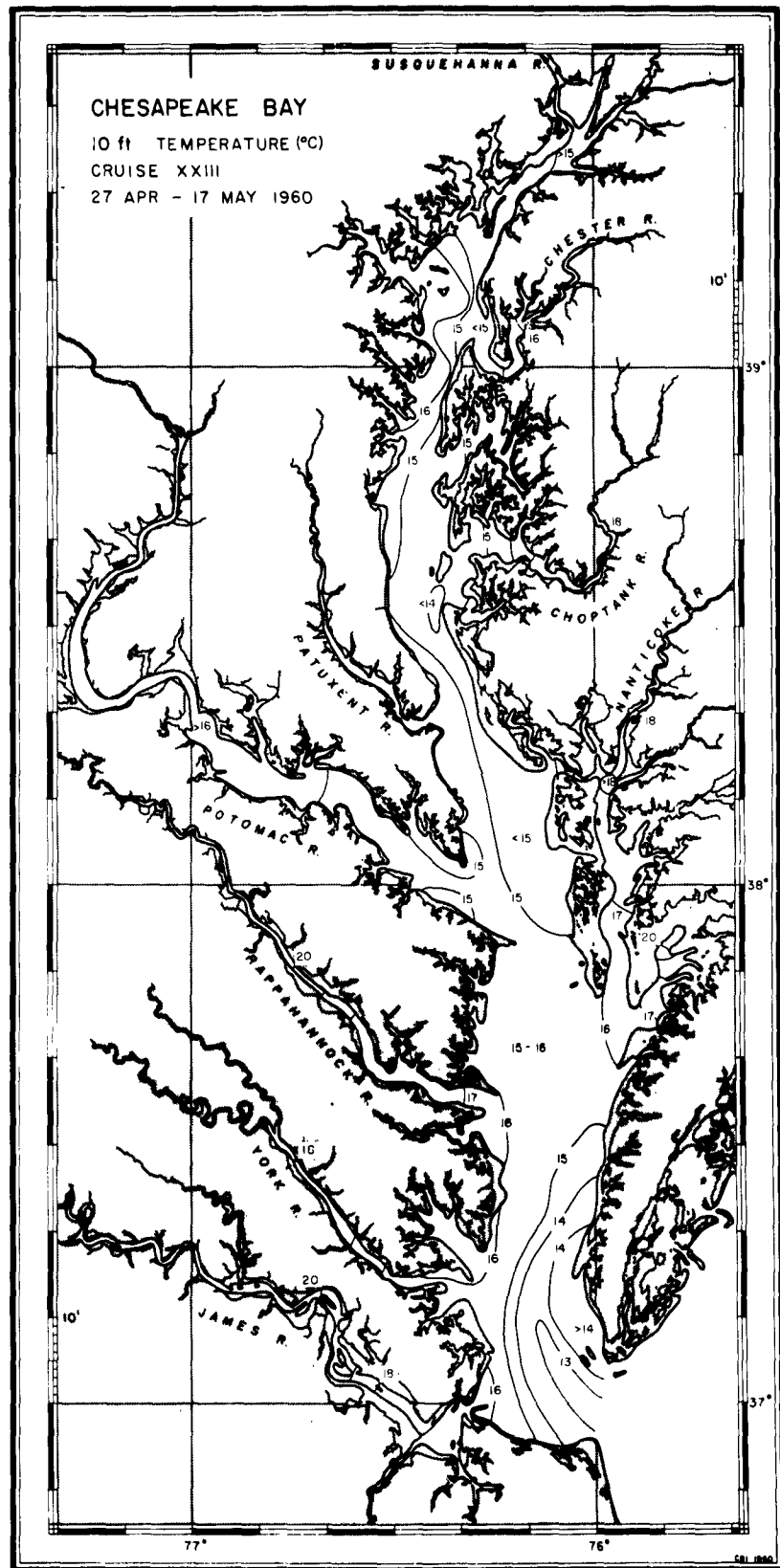


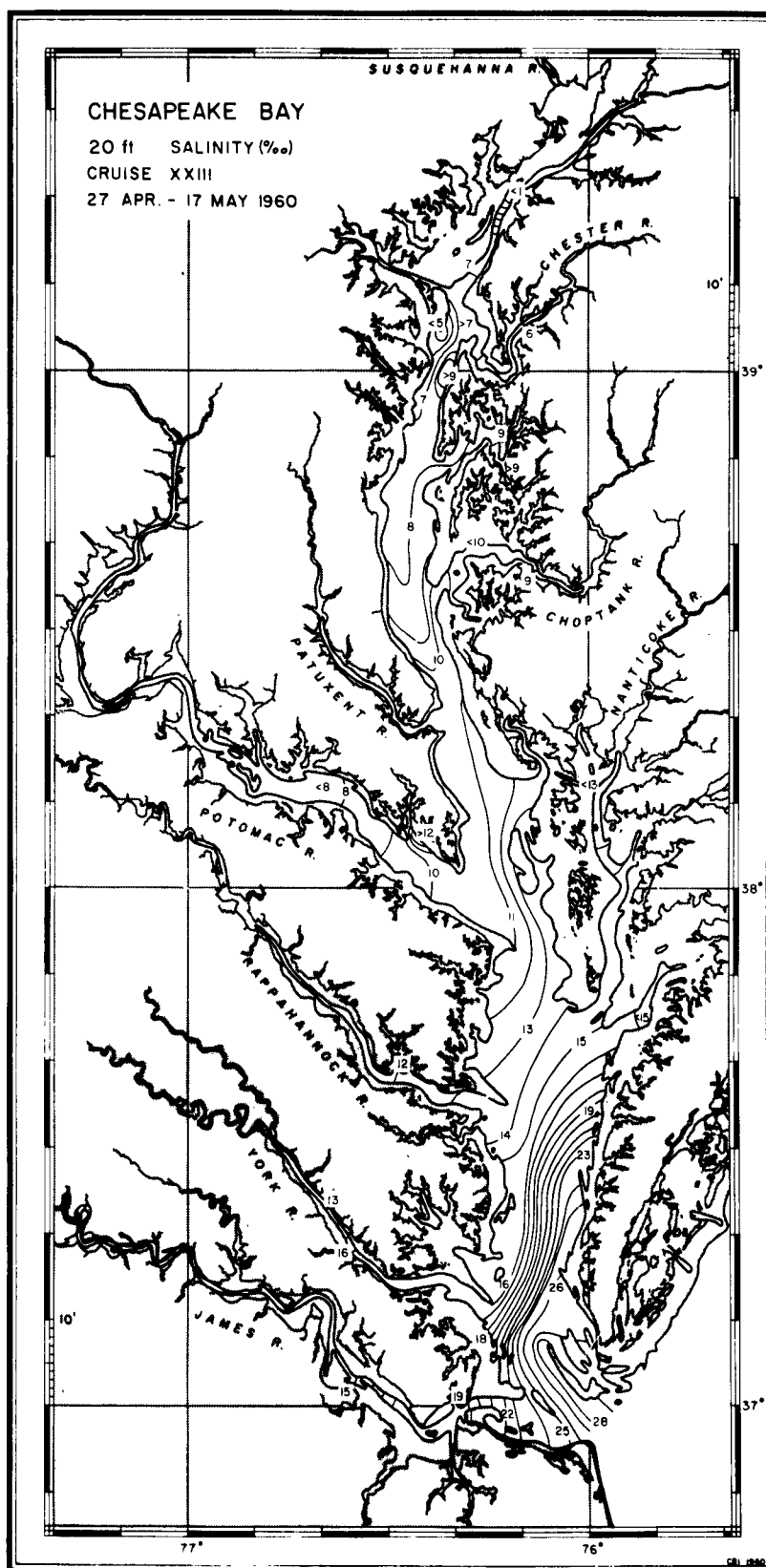


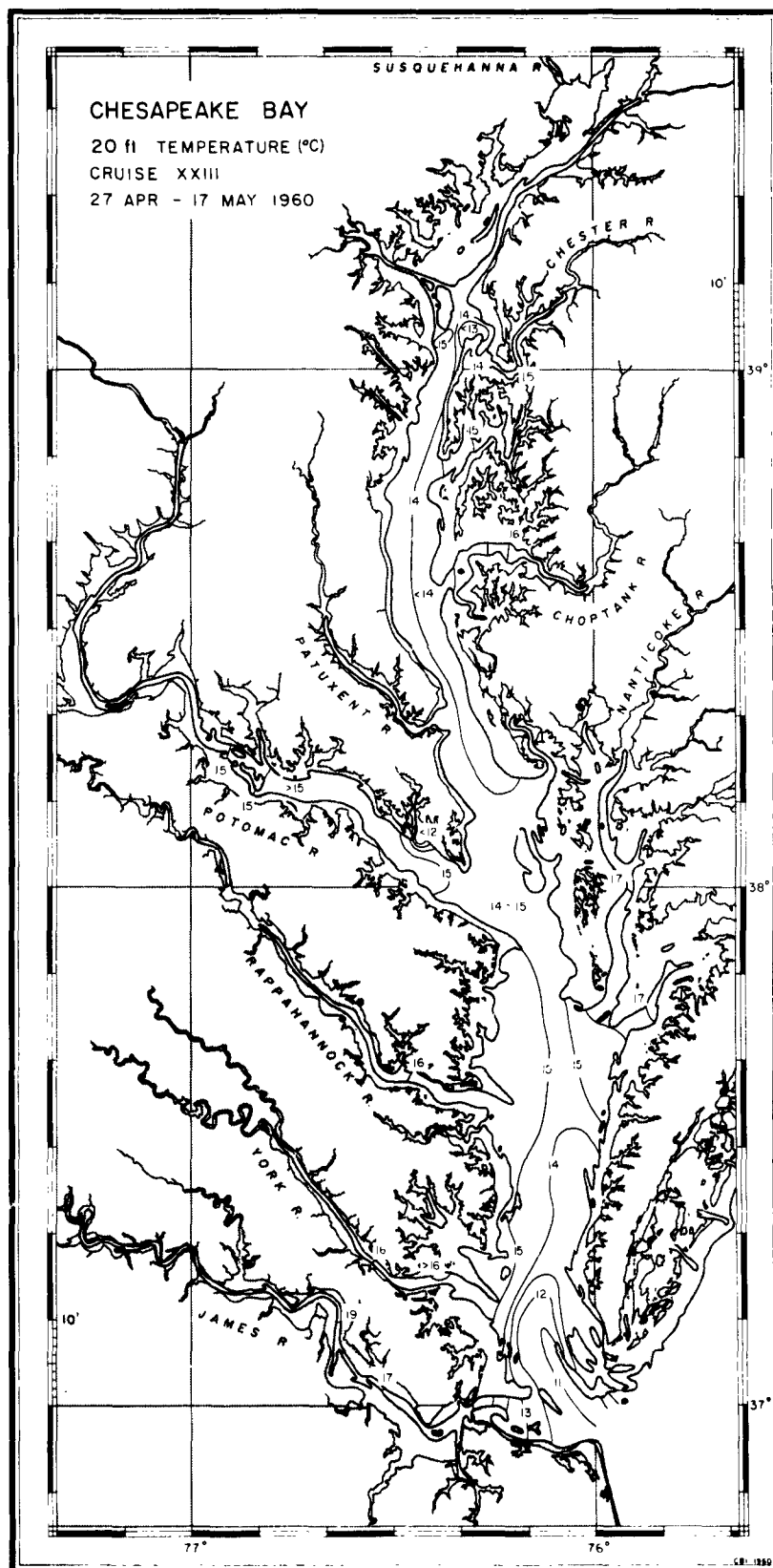


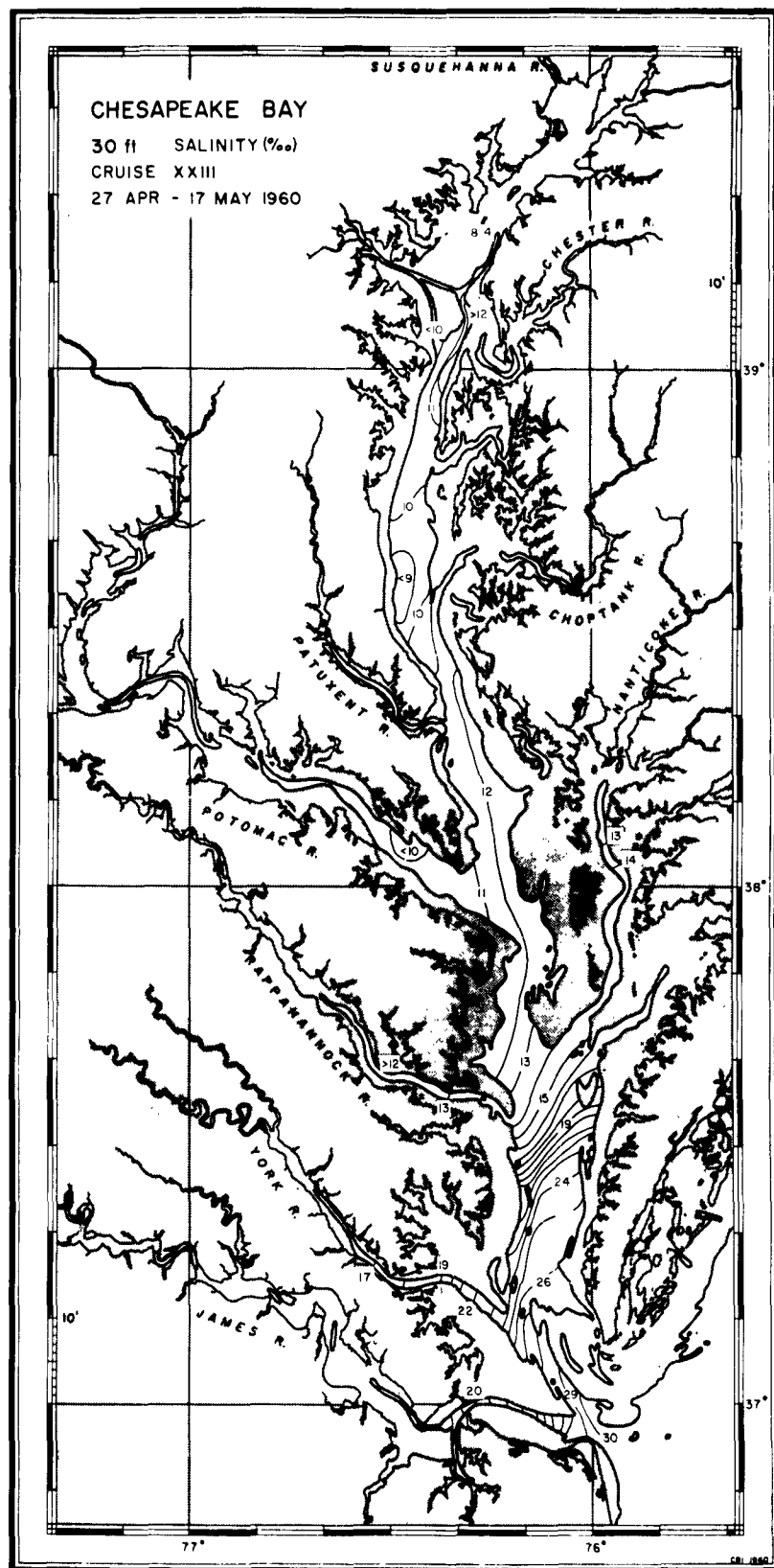


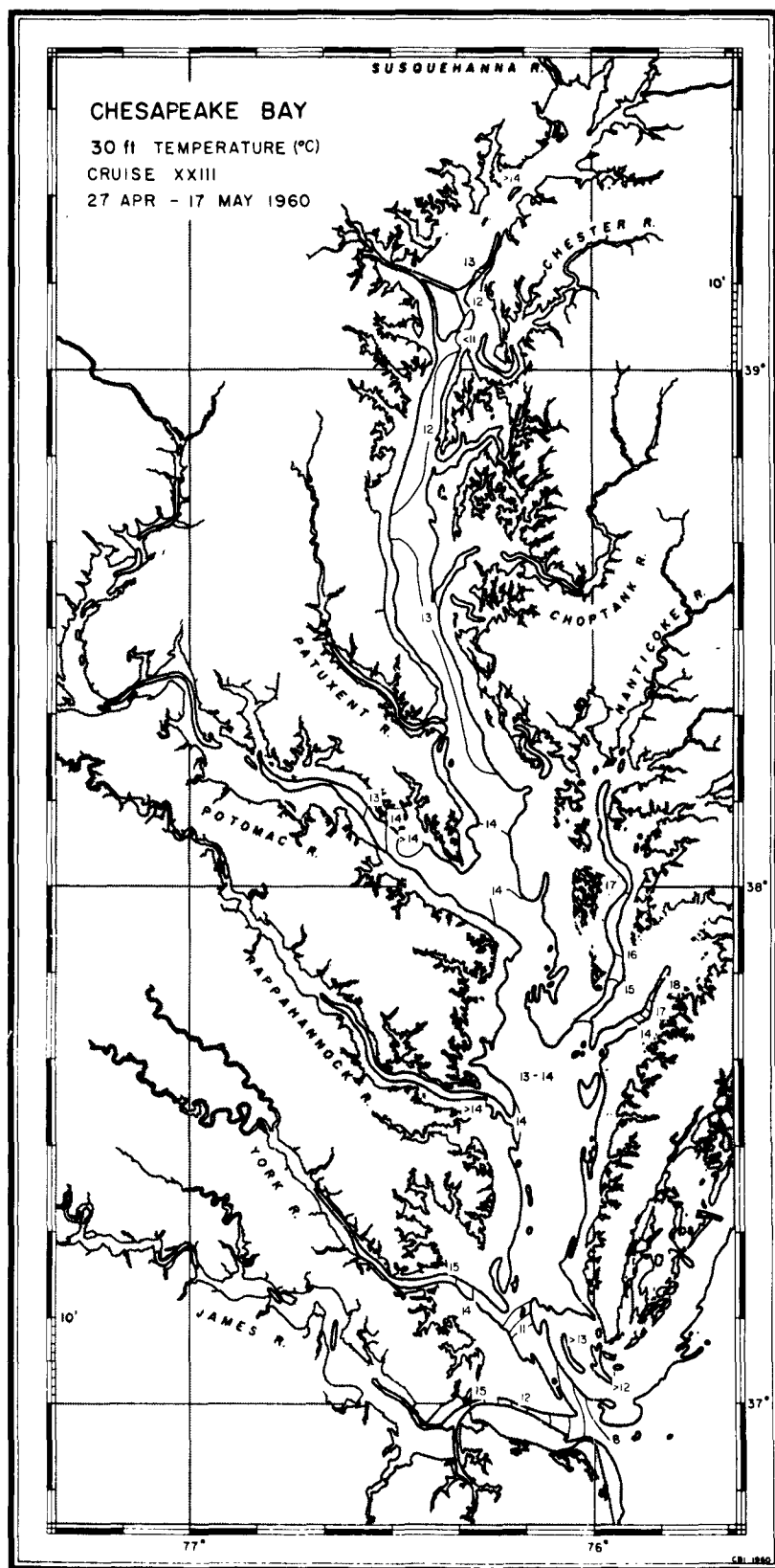


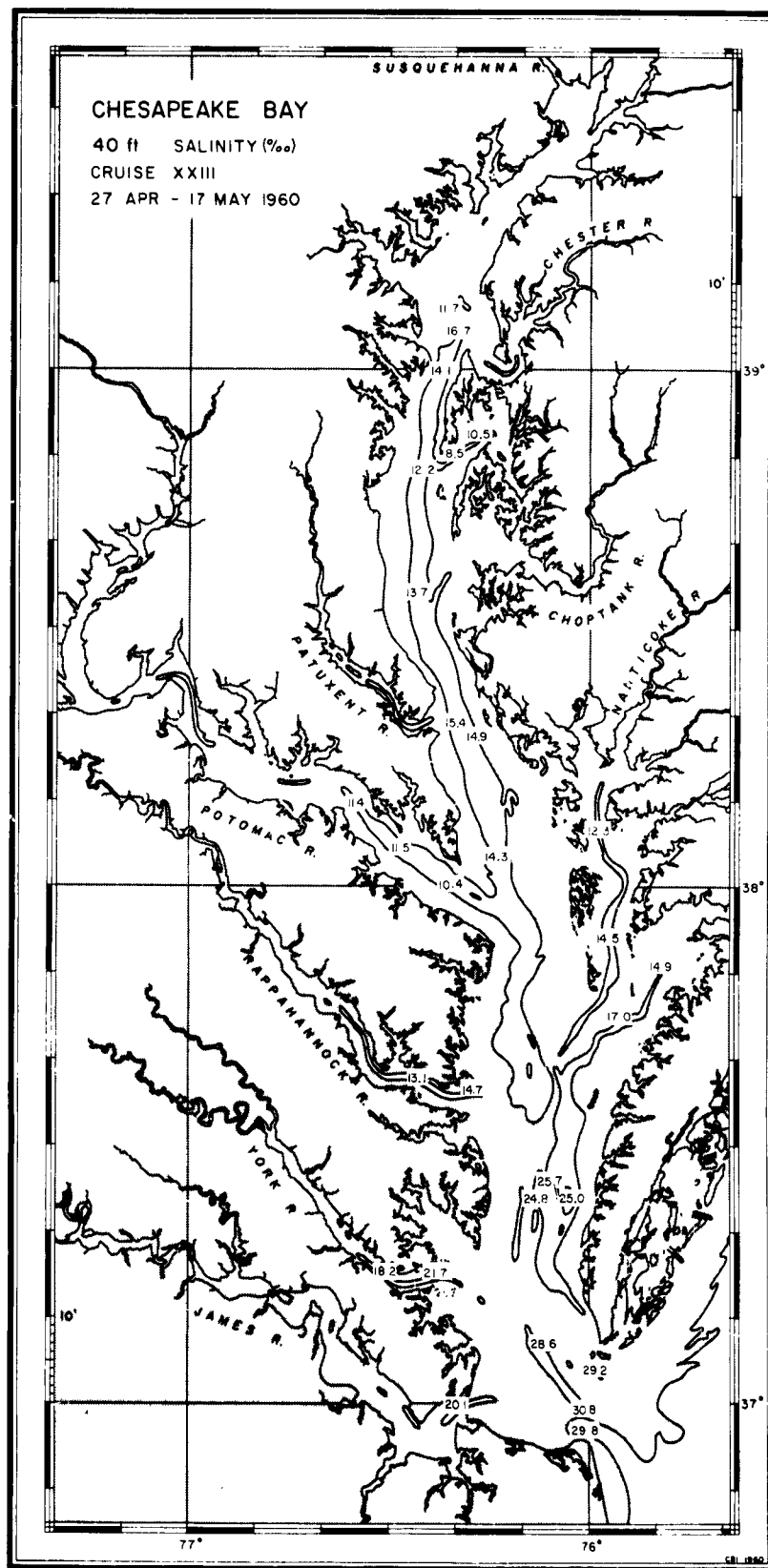


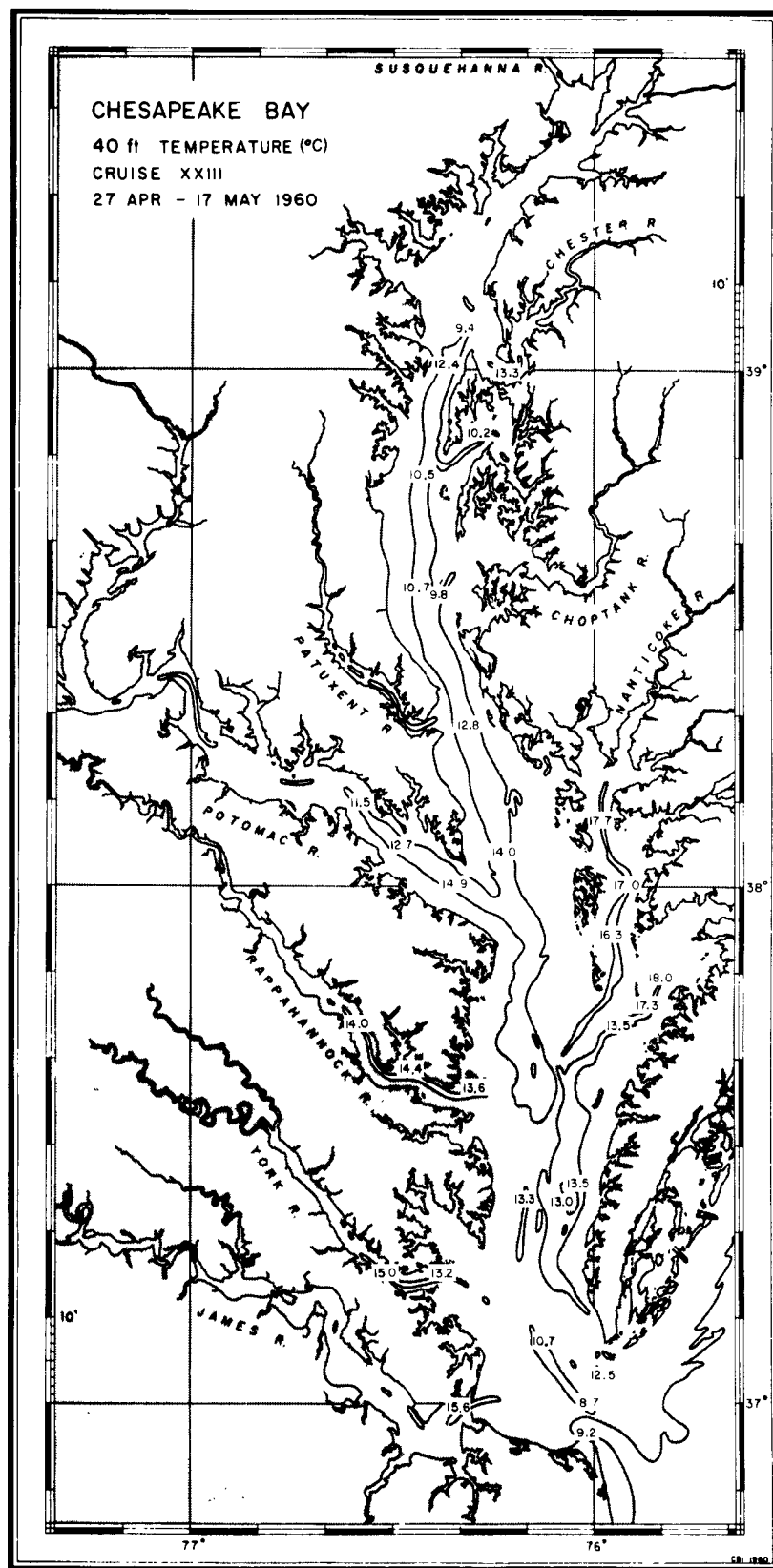


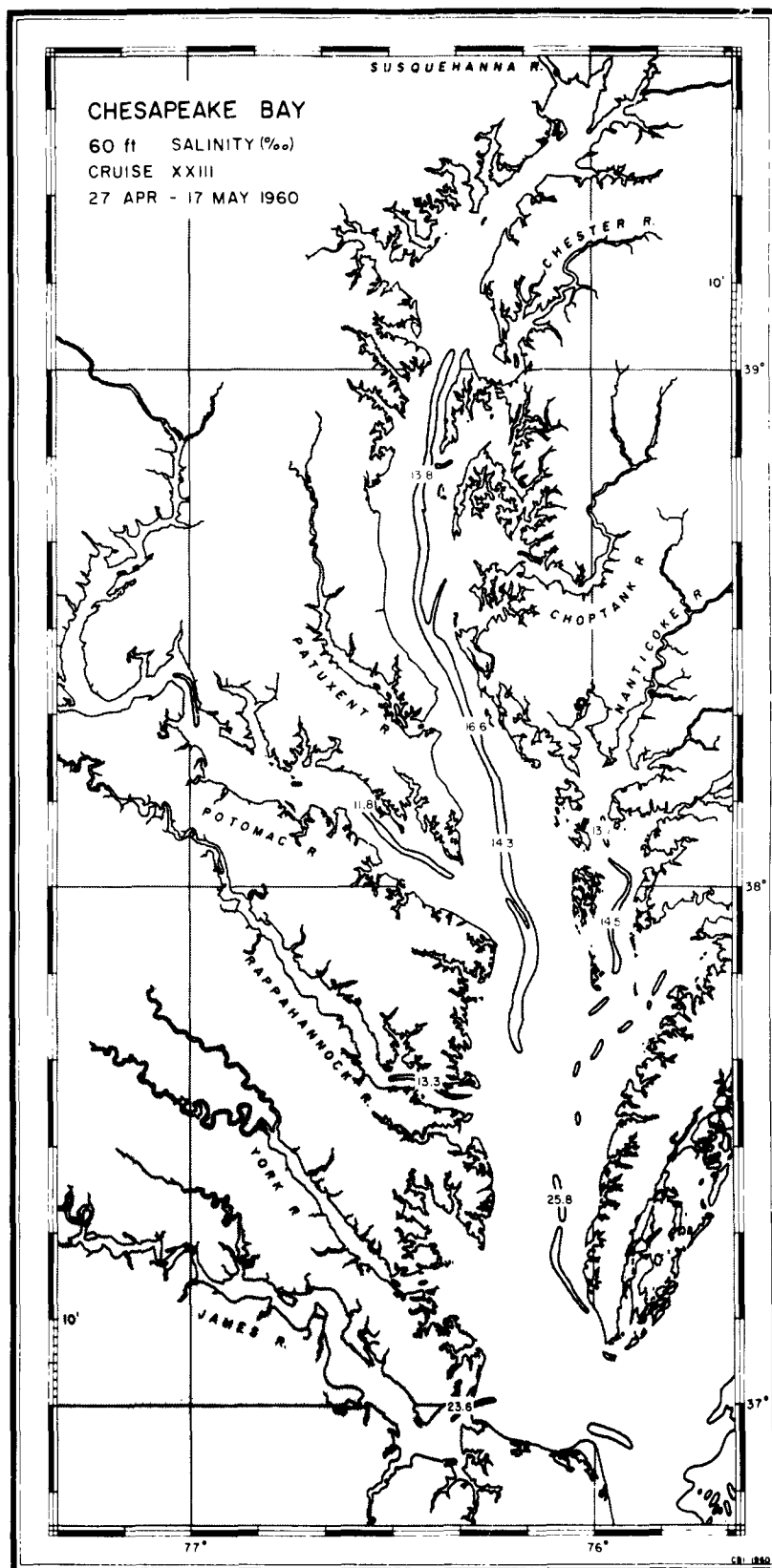


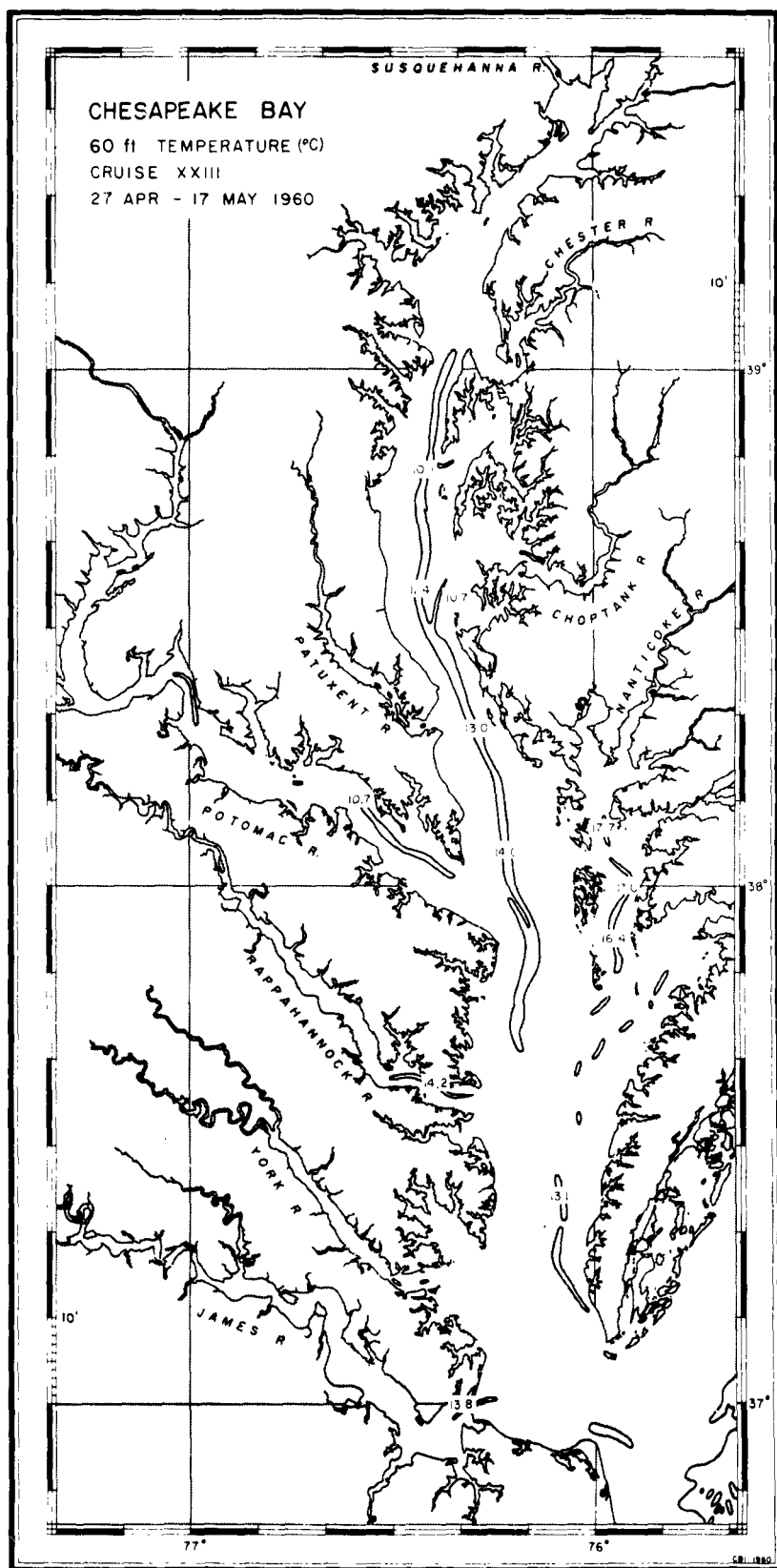




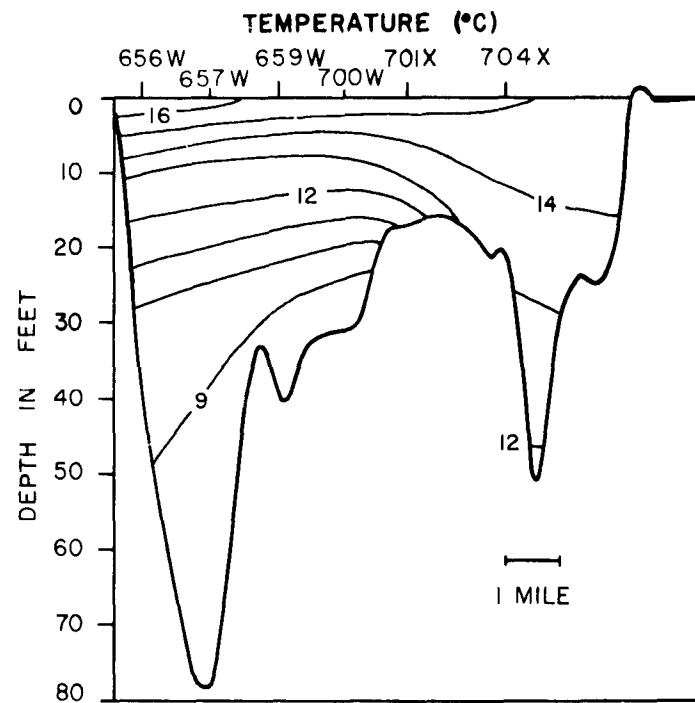
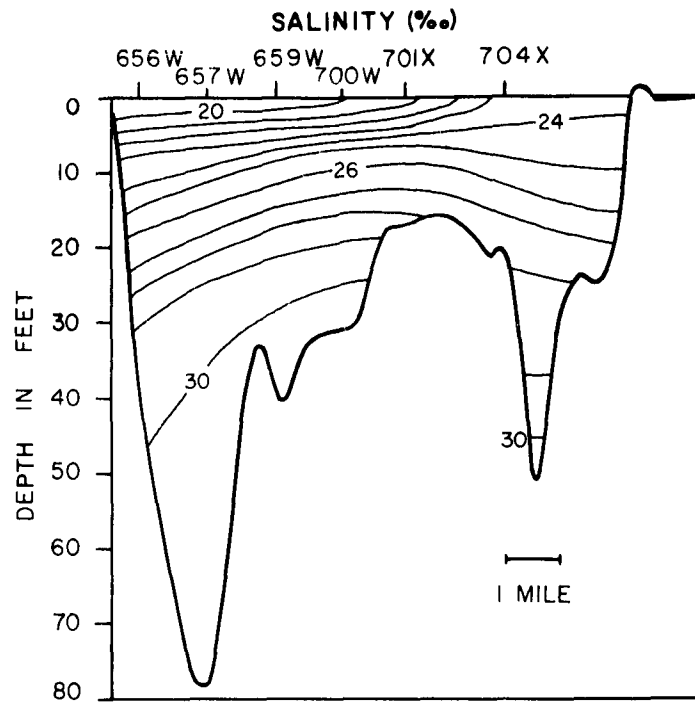




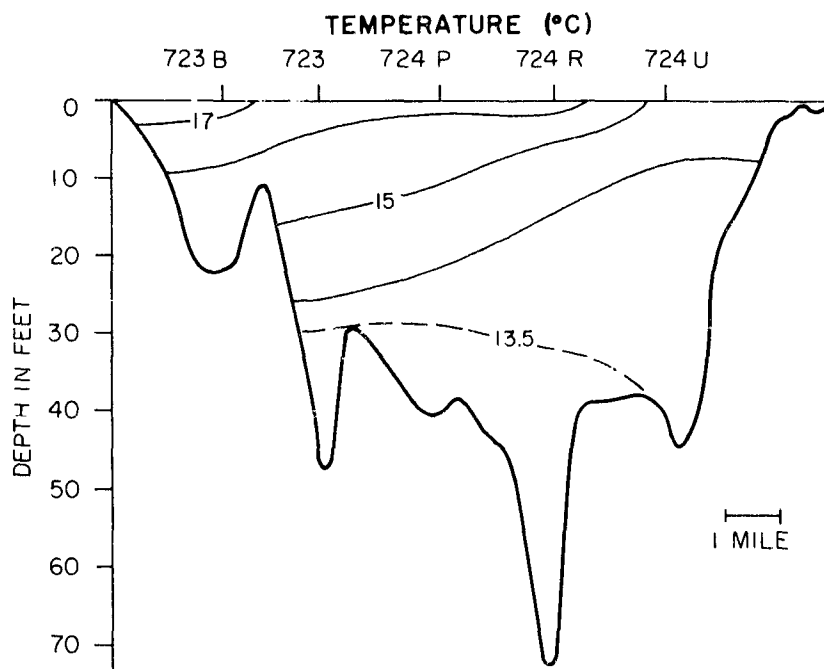
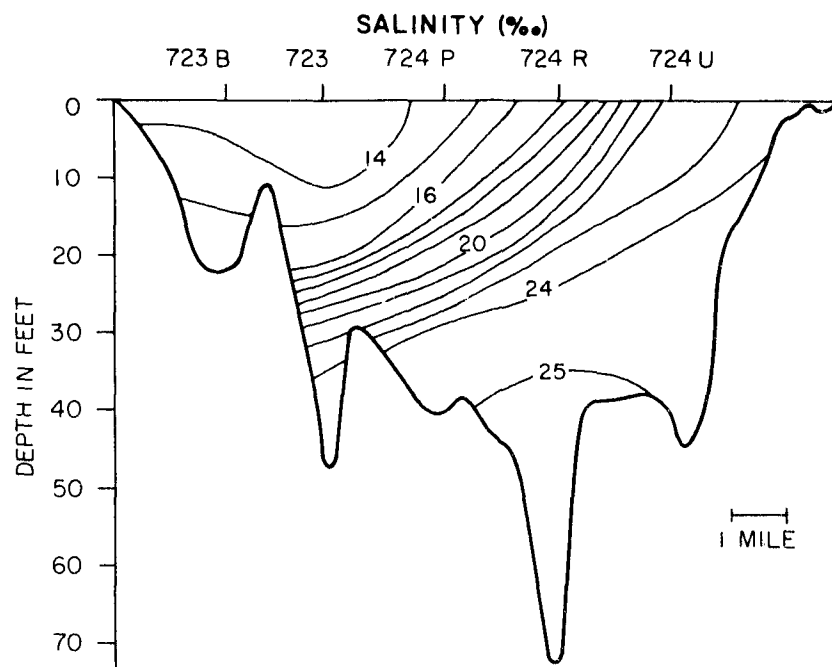




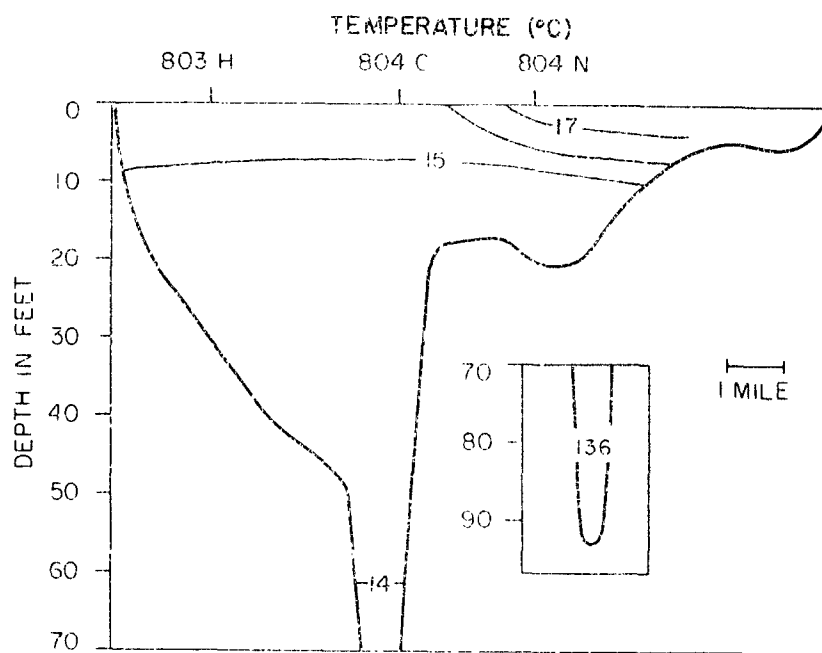
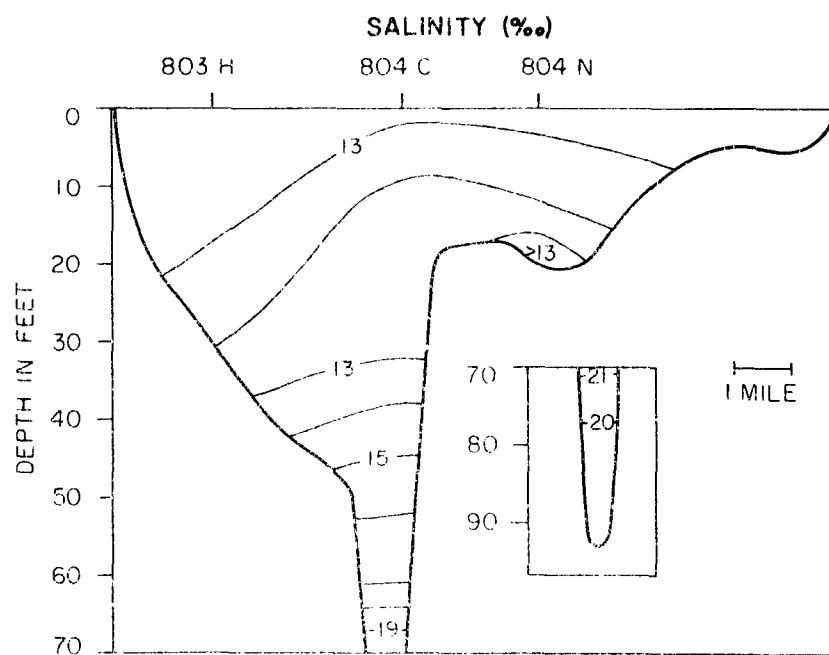
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION II



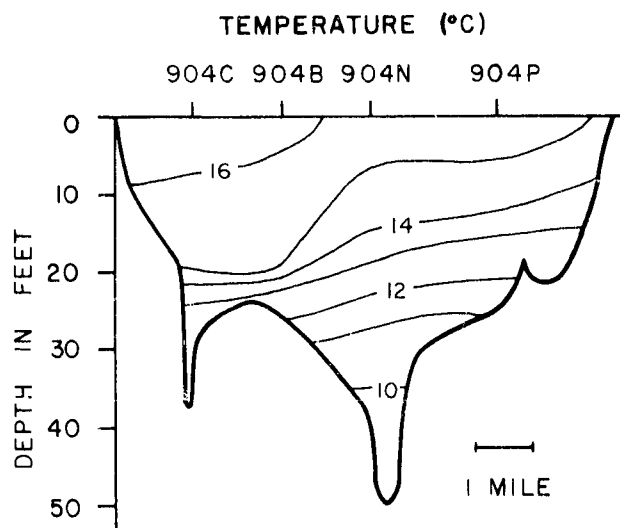
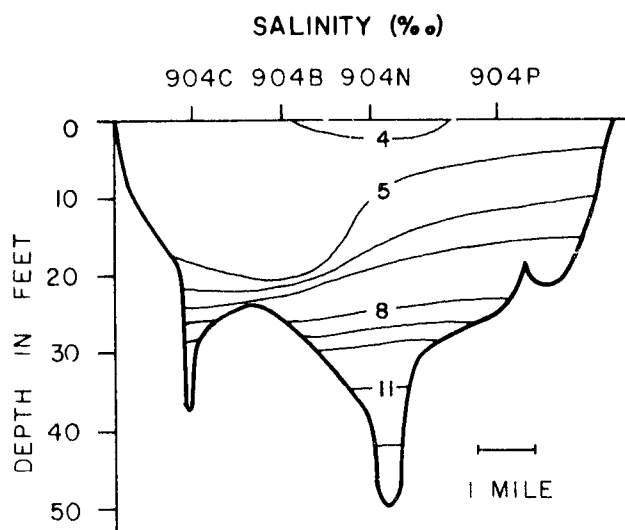
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION IV



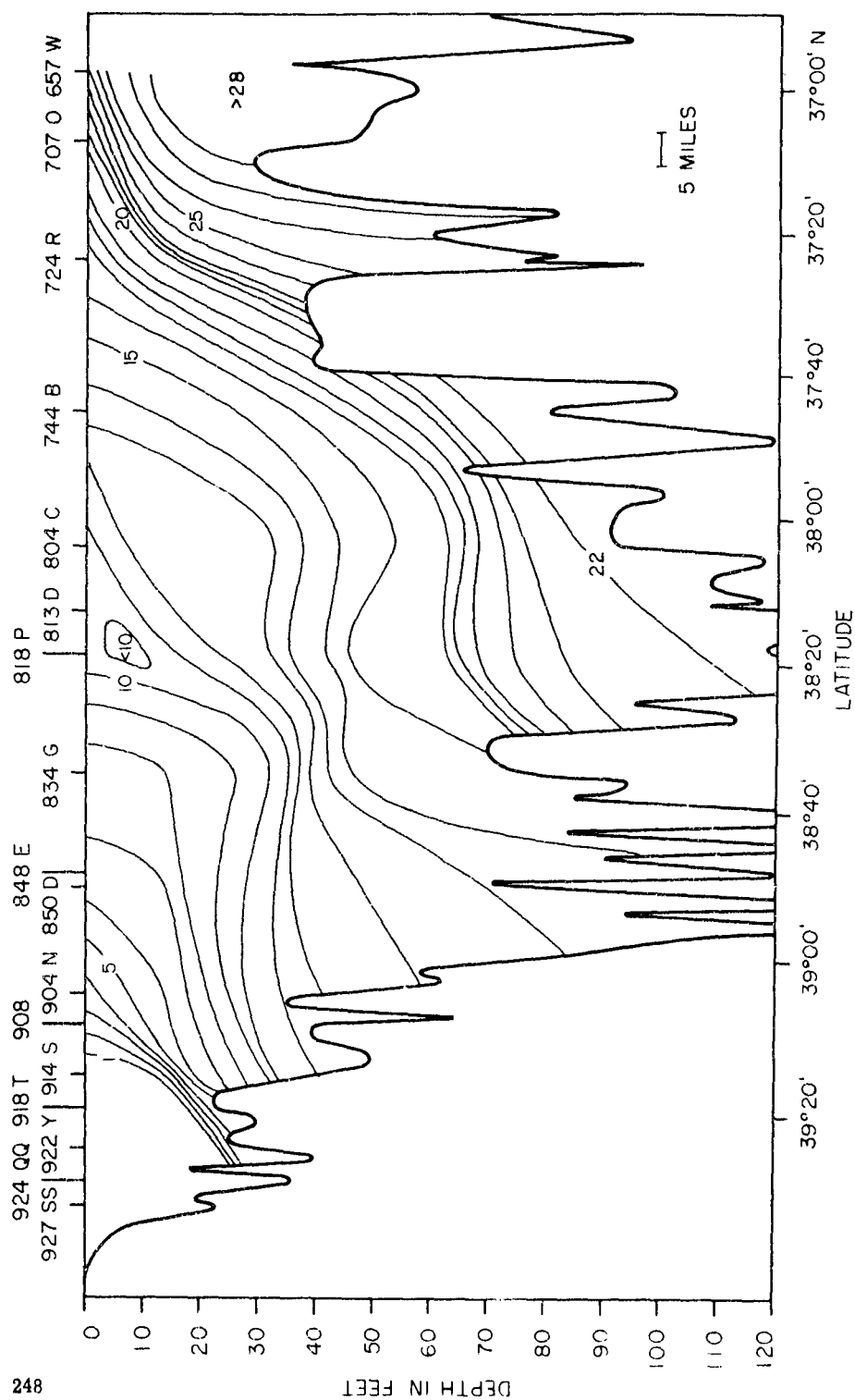
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION VI



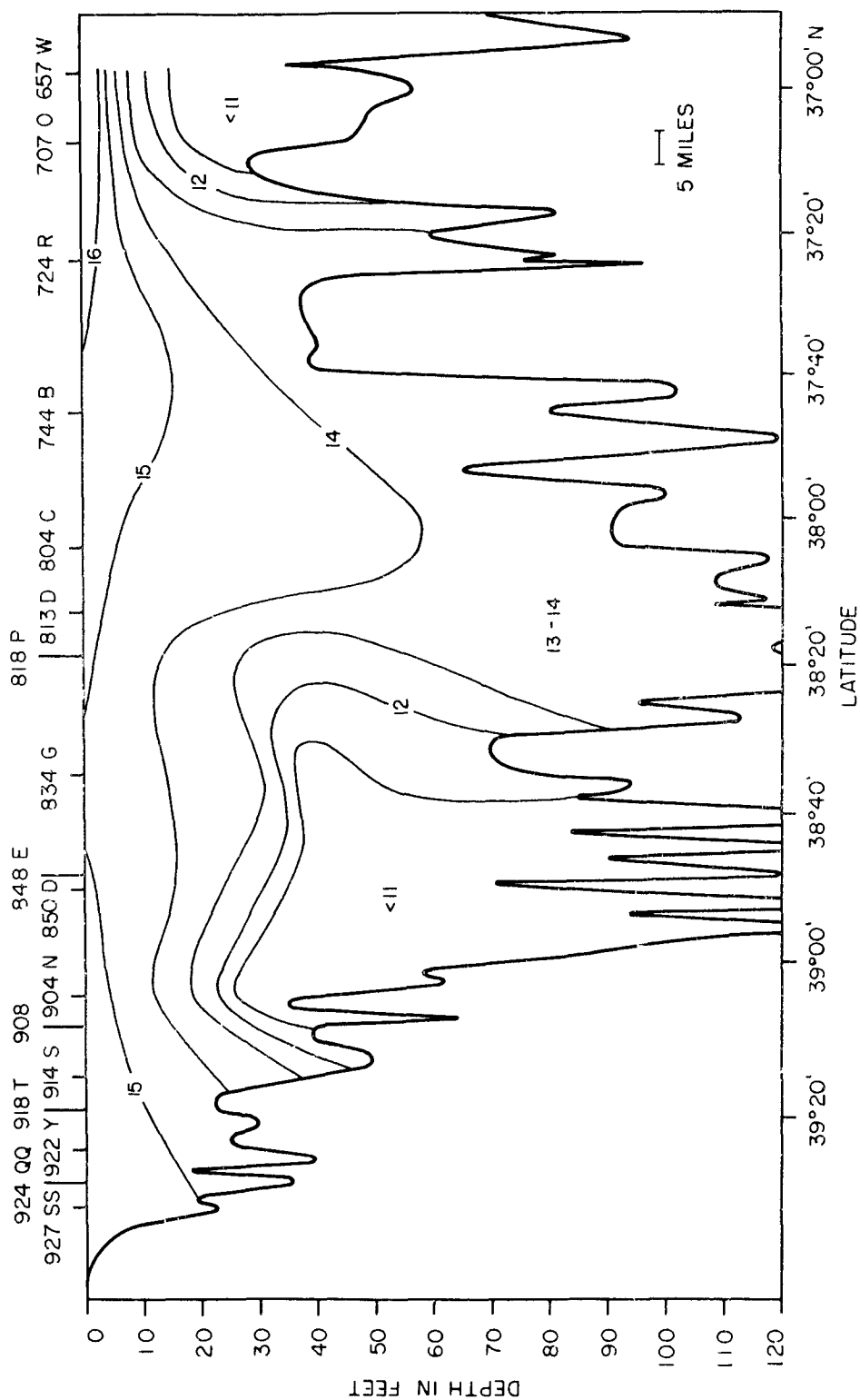
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION X

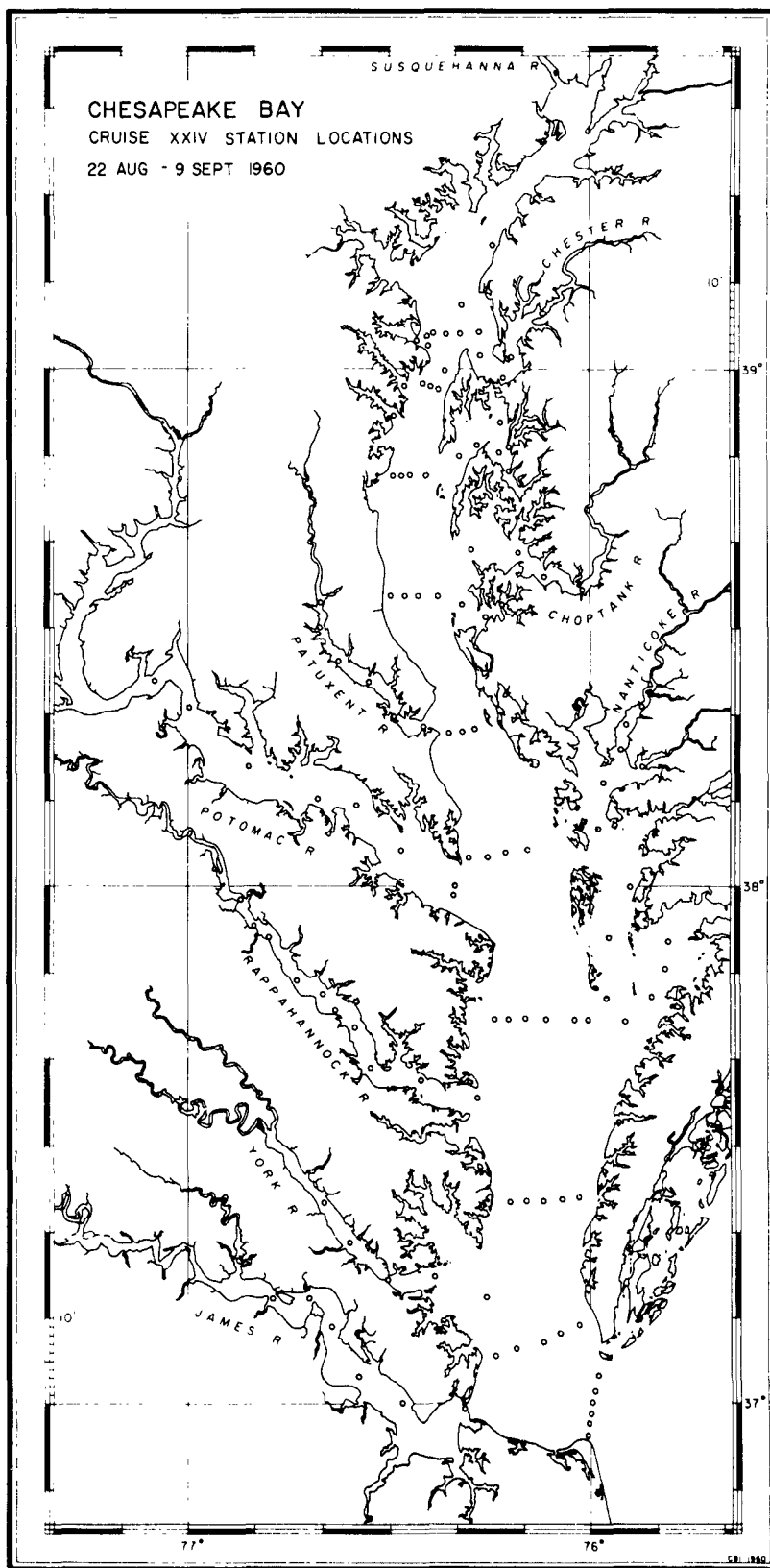


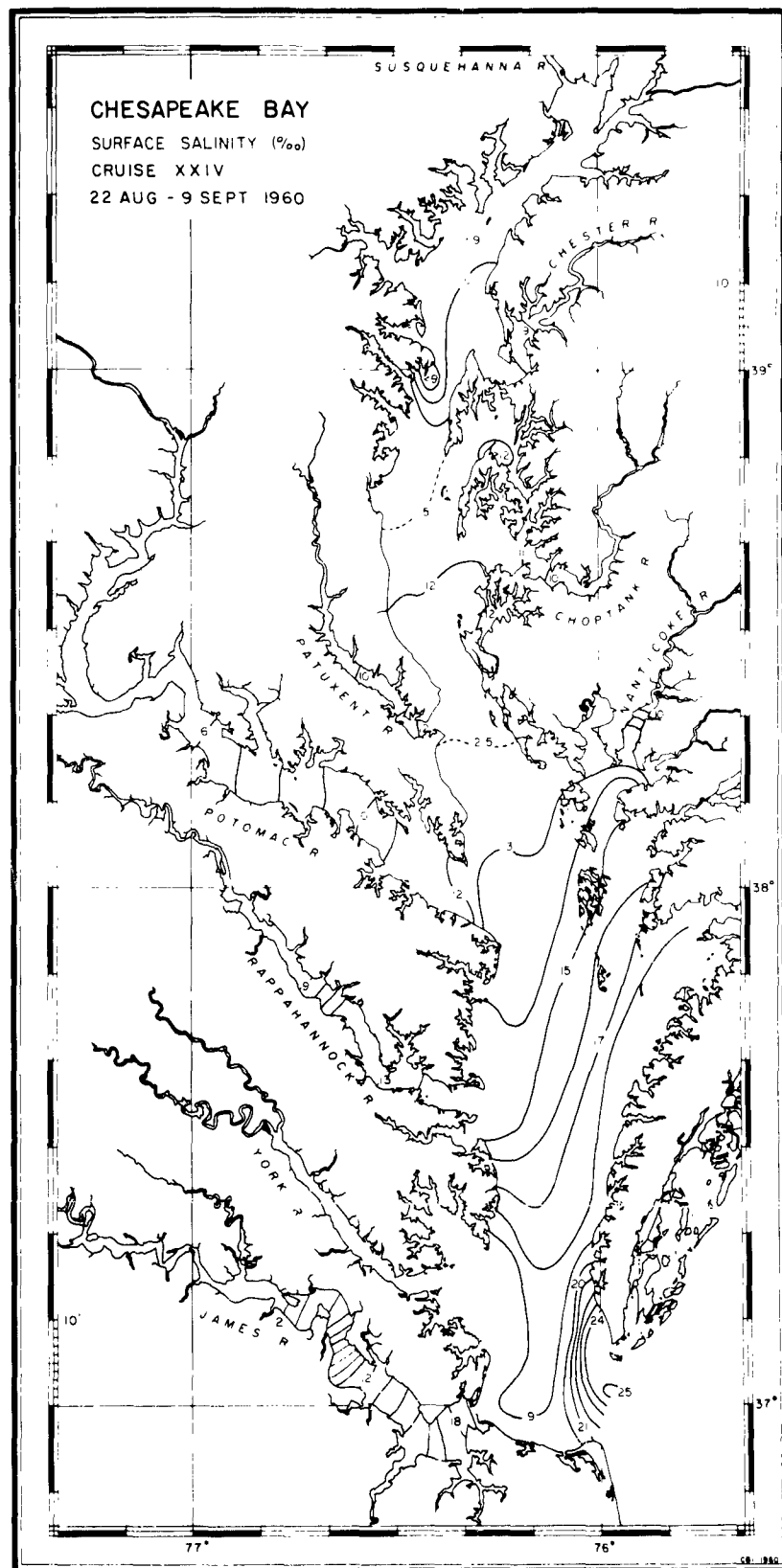
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION XIX
SALINITY (‰)

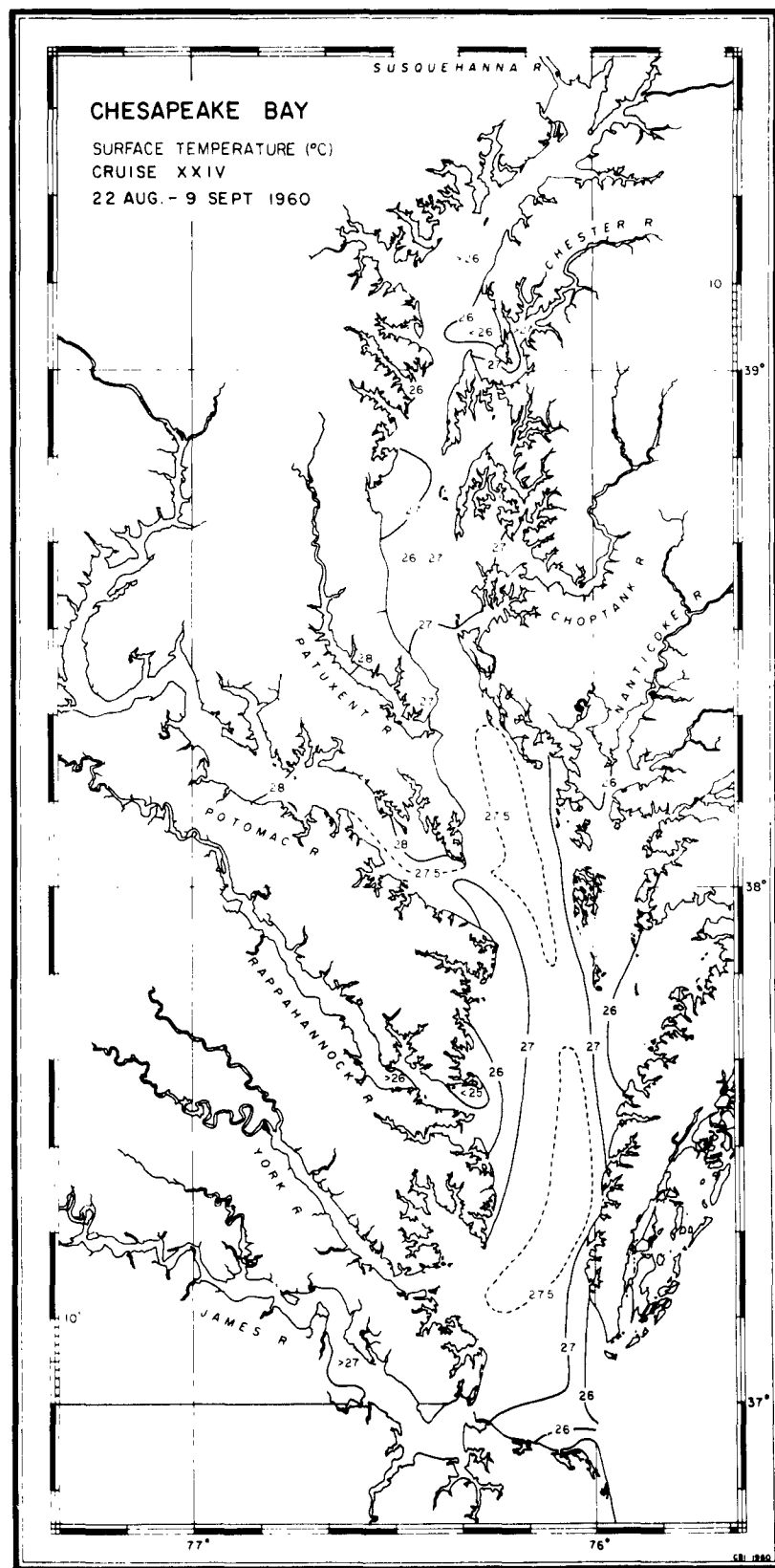


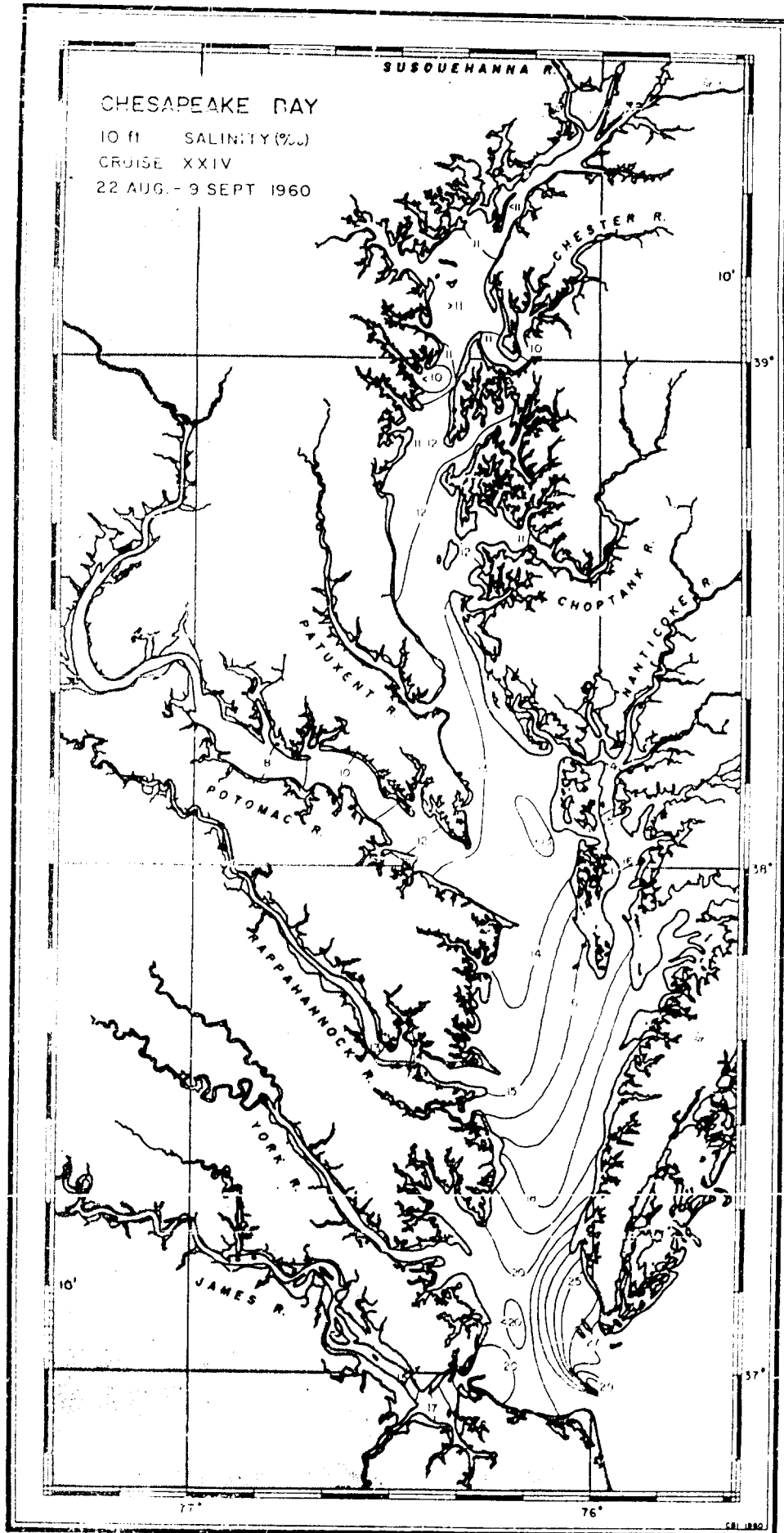
CRUISE XXIII 27 APRIL - 17 MAY 1960 SECTION XIX
TEMPERATURE (°C)

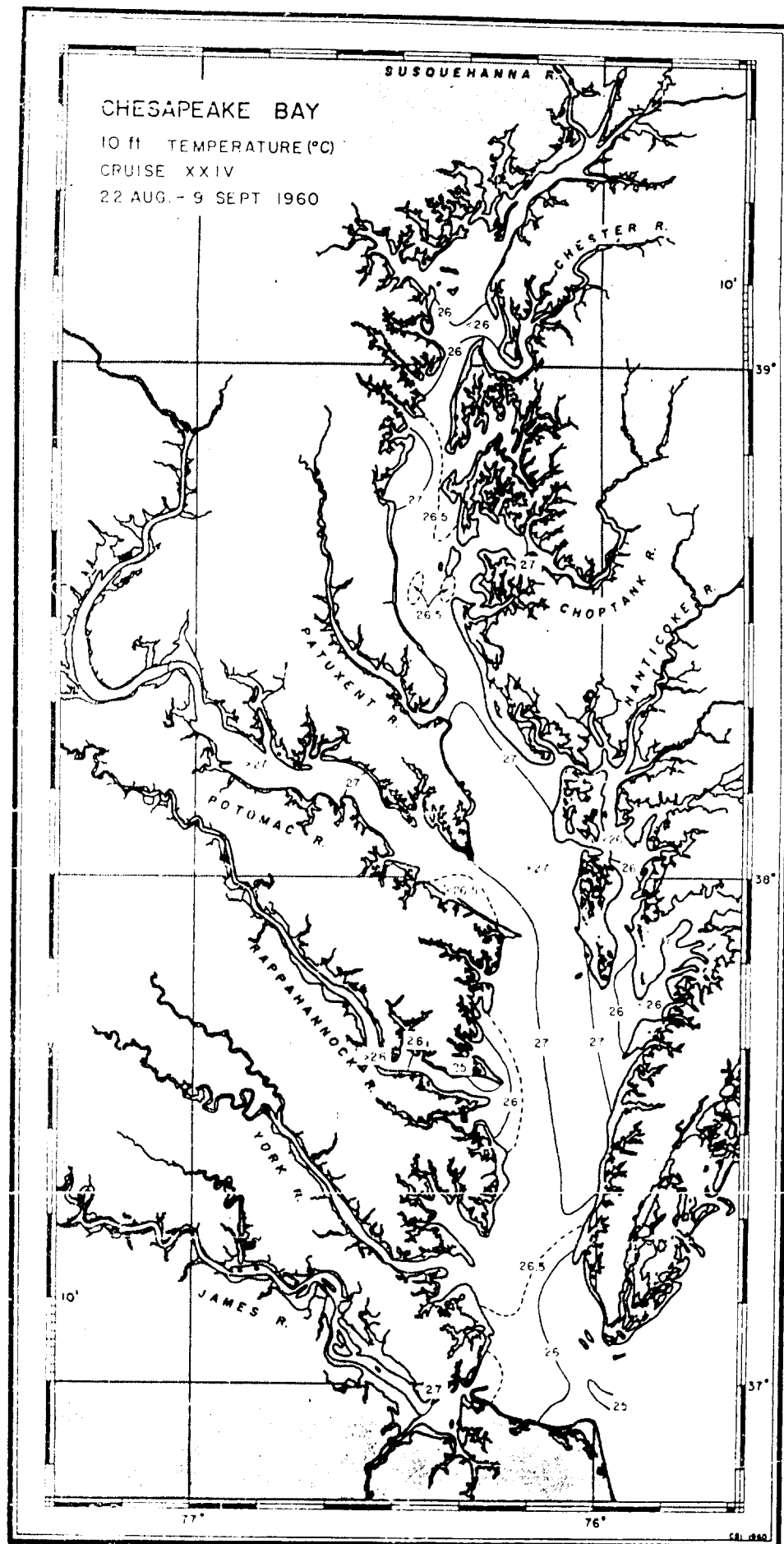


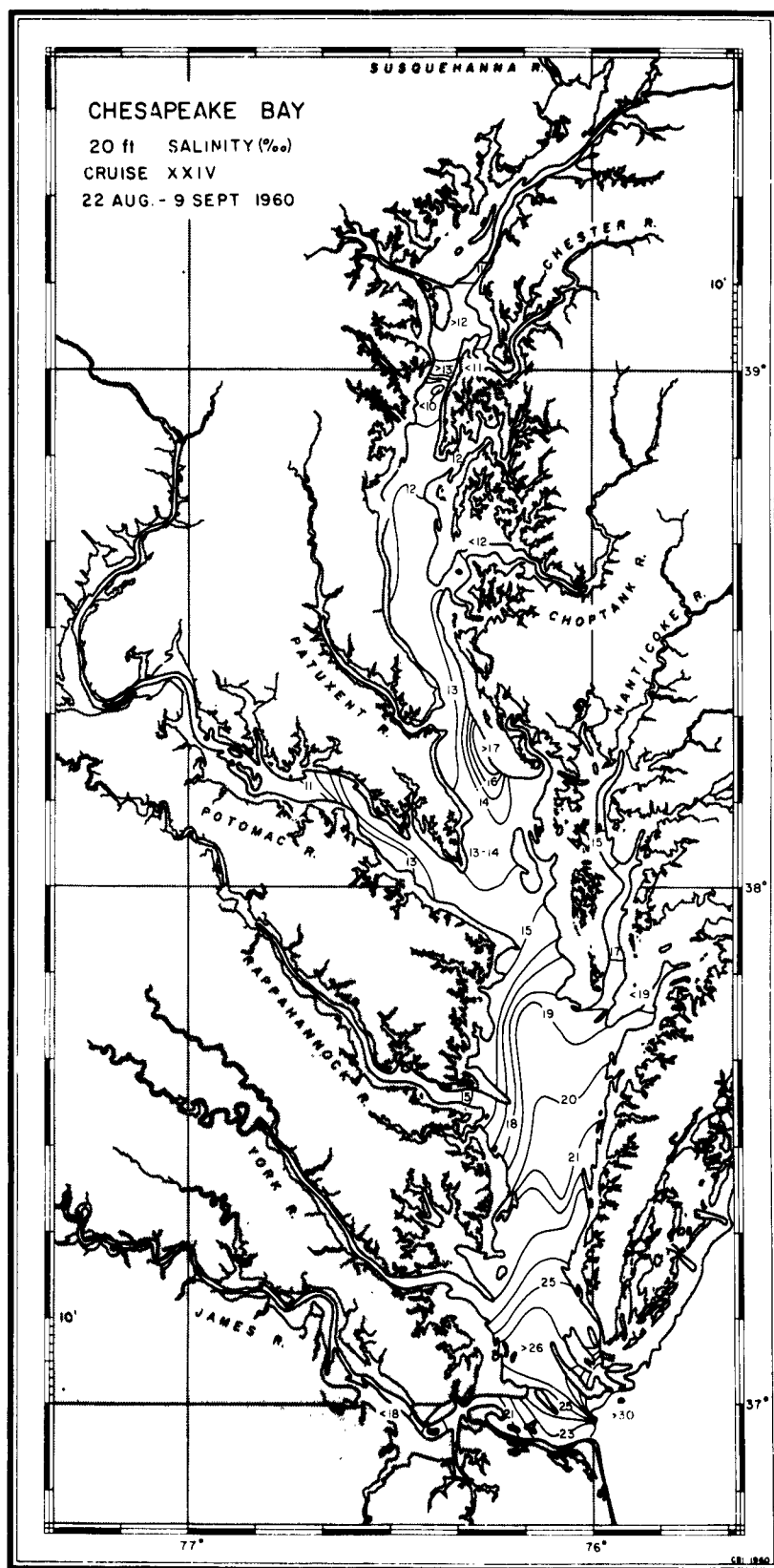


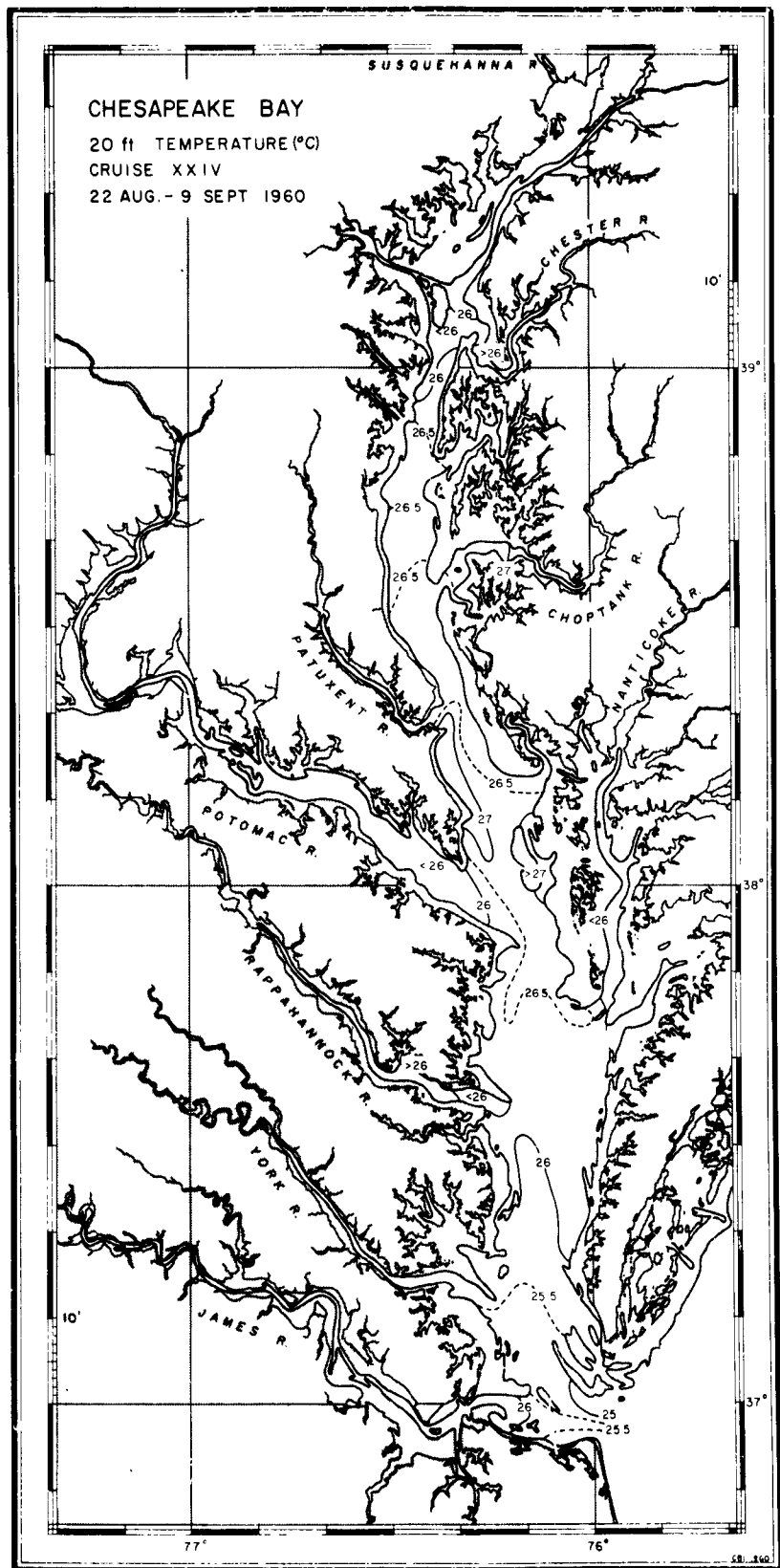


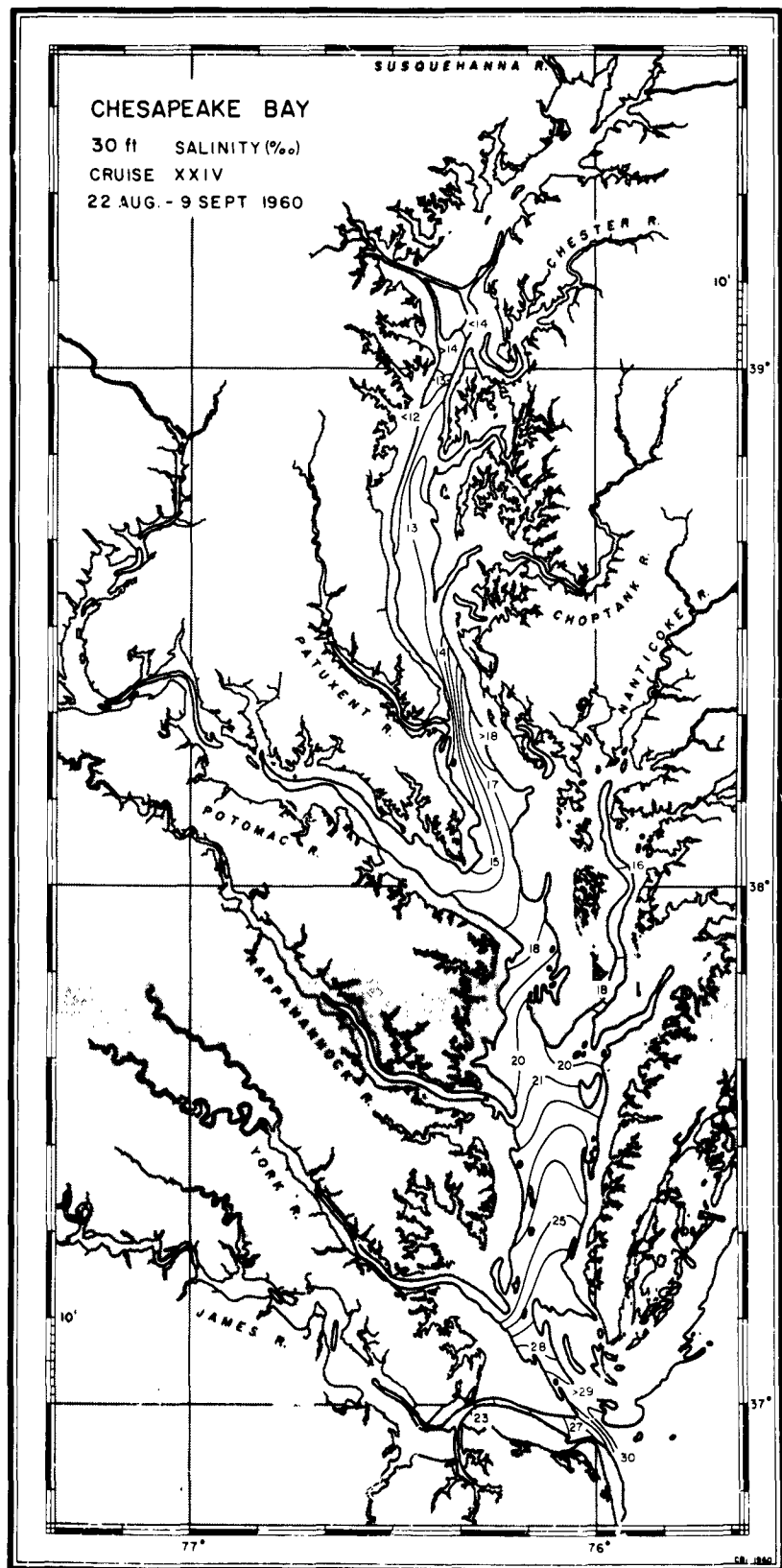


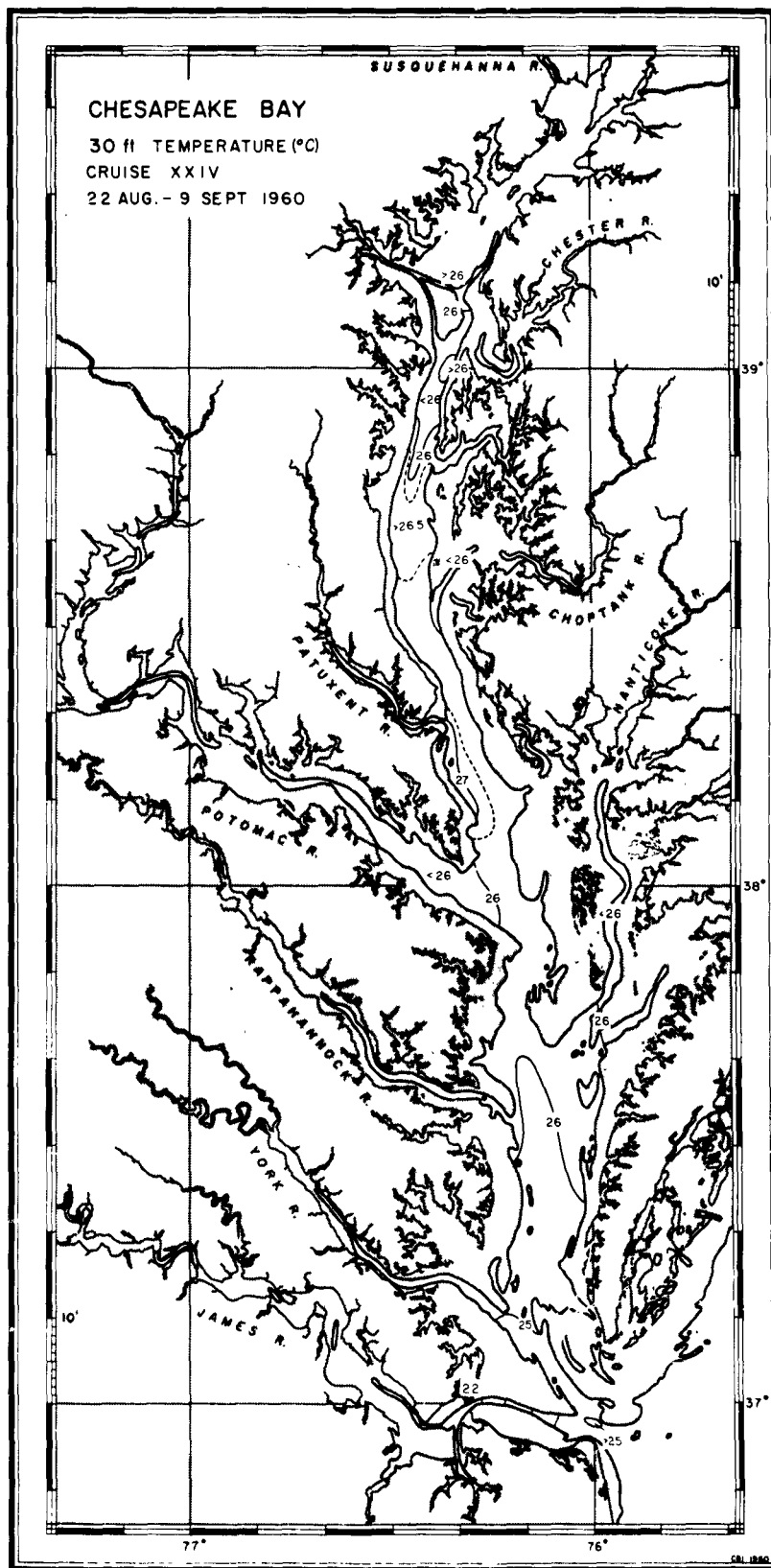


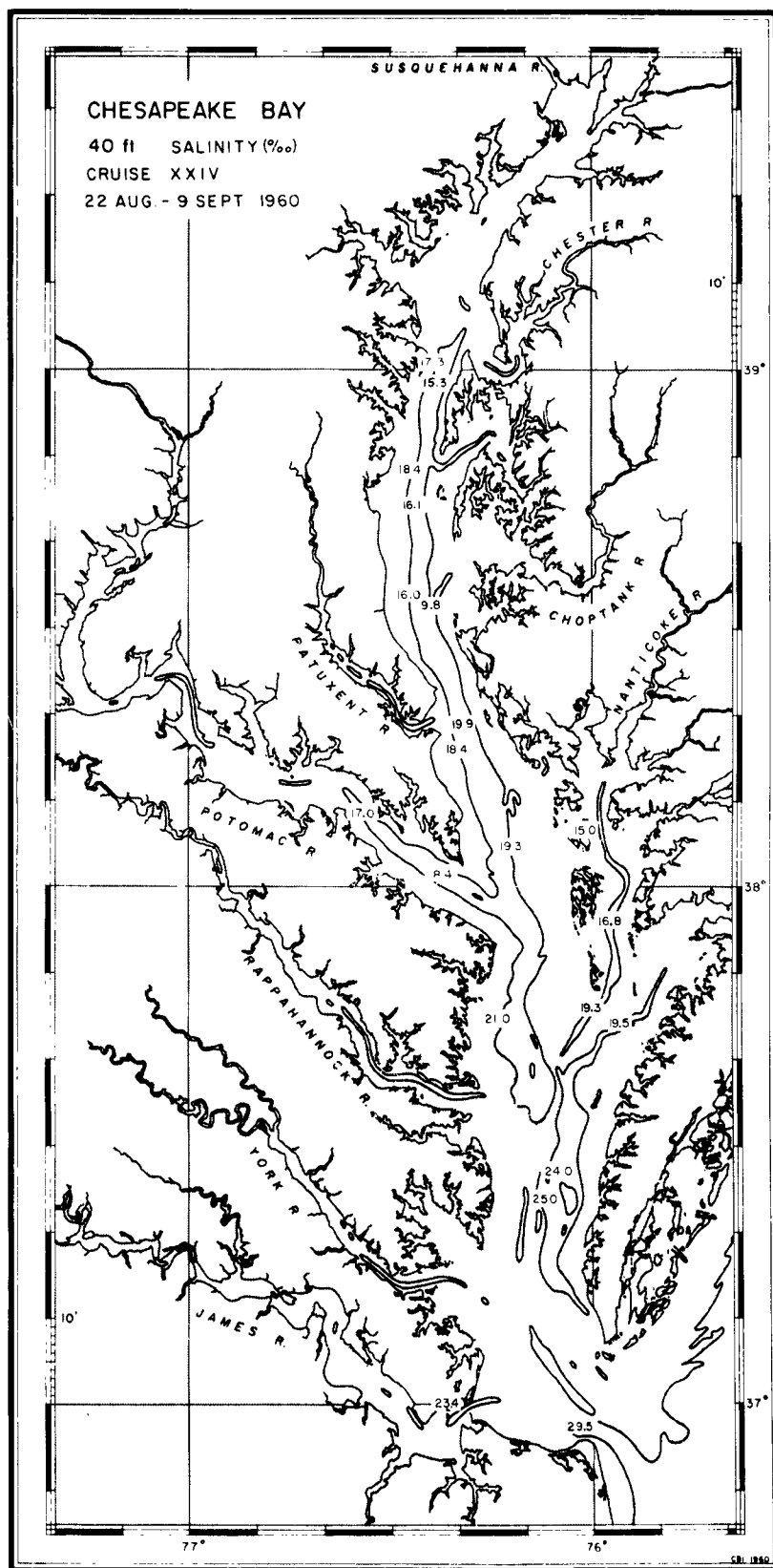


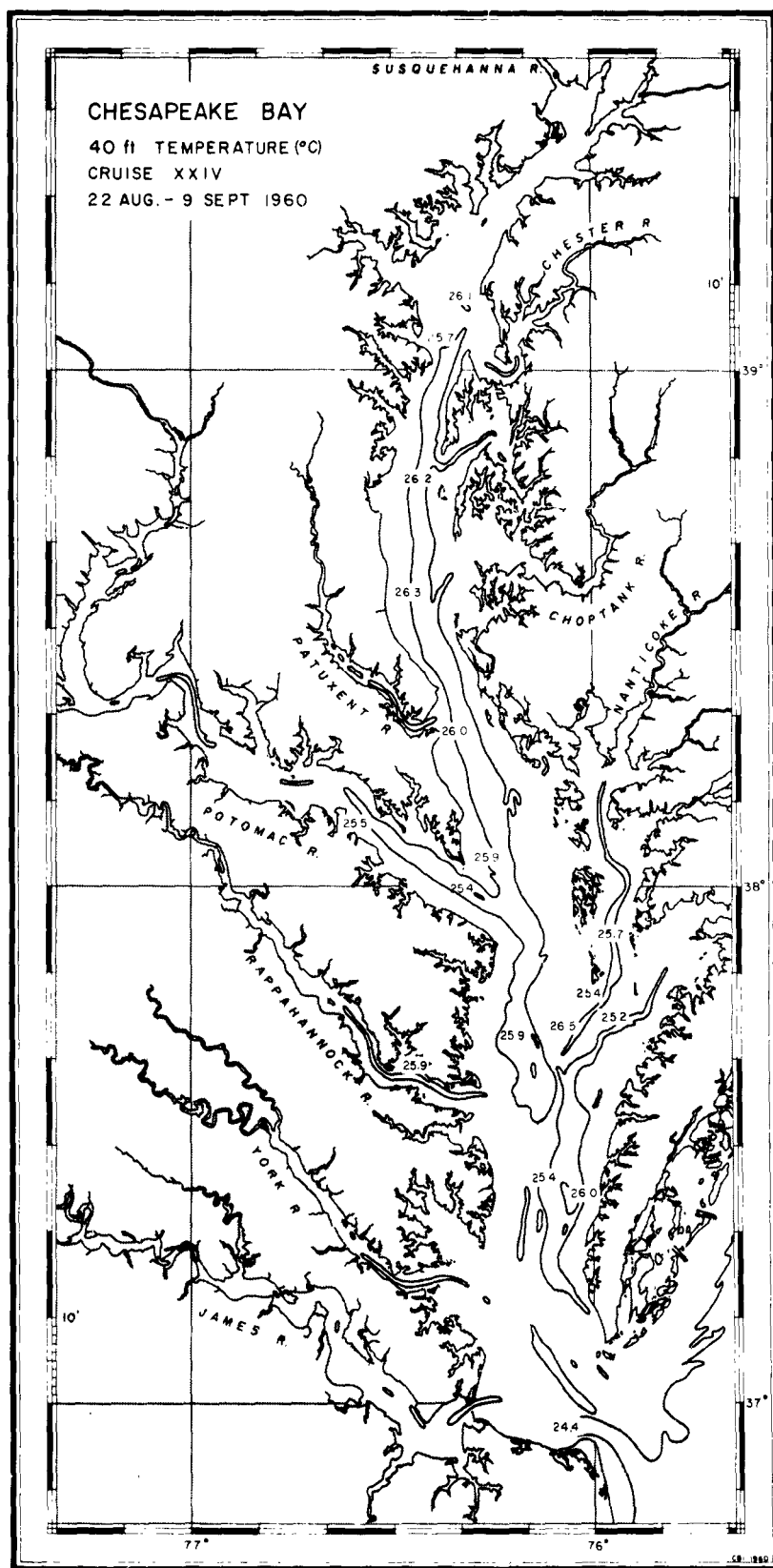


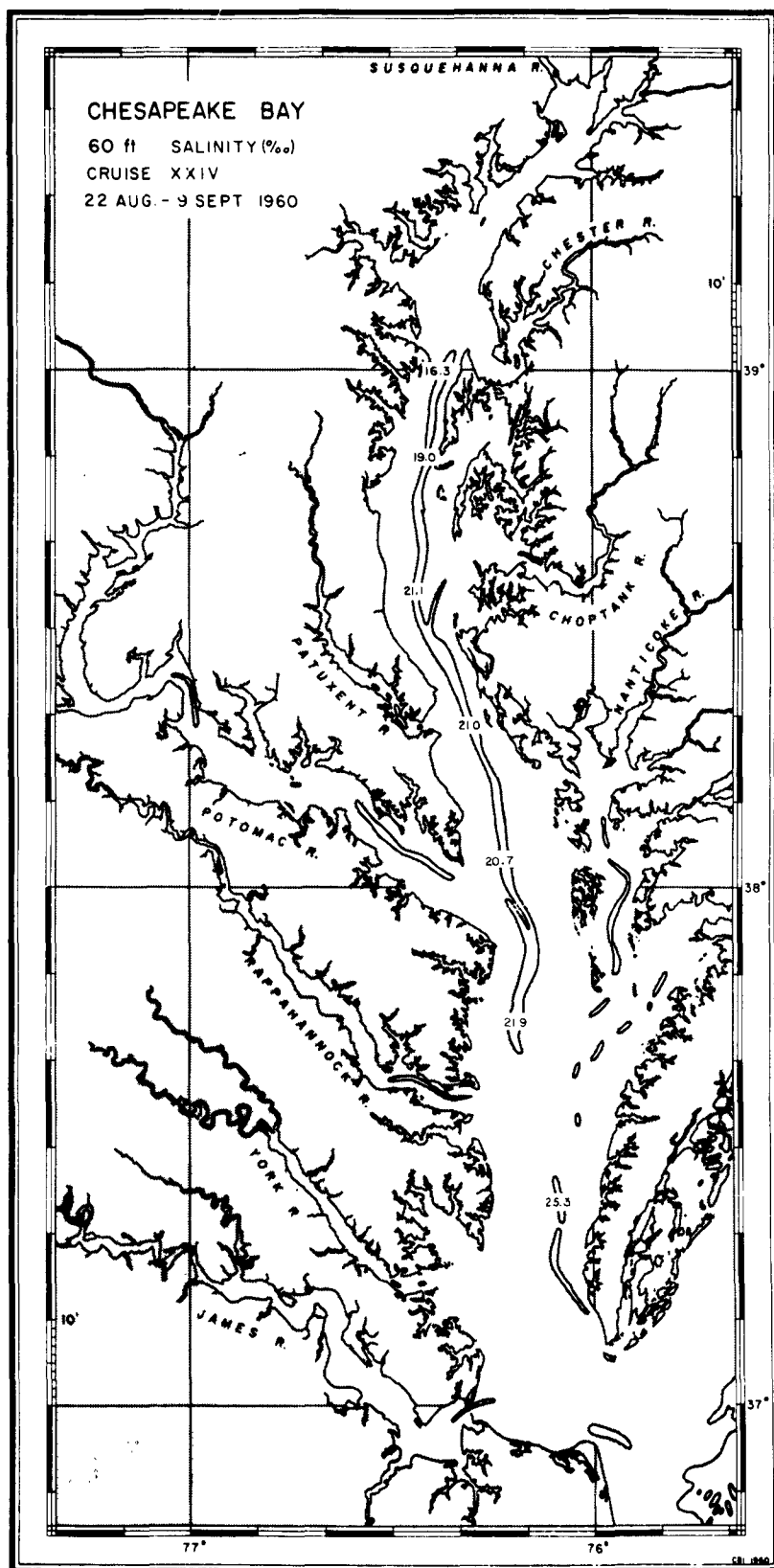


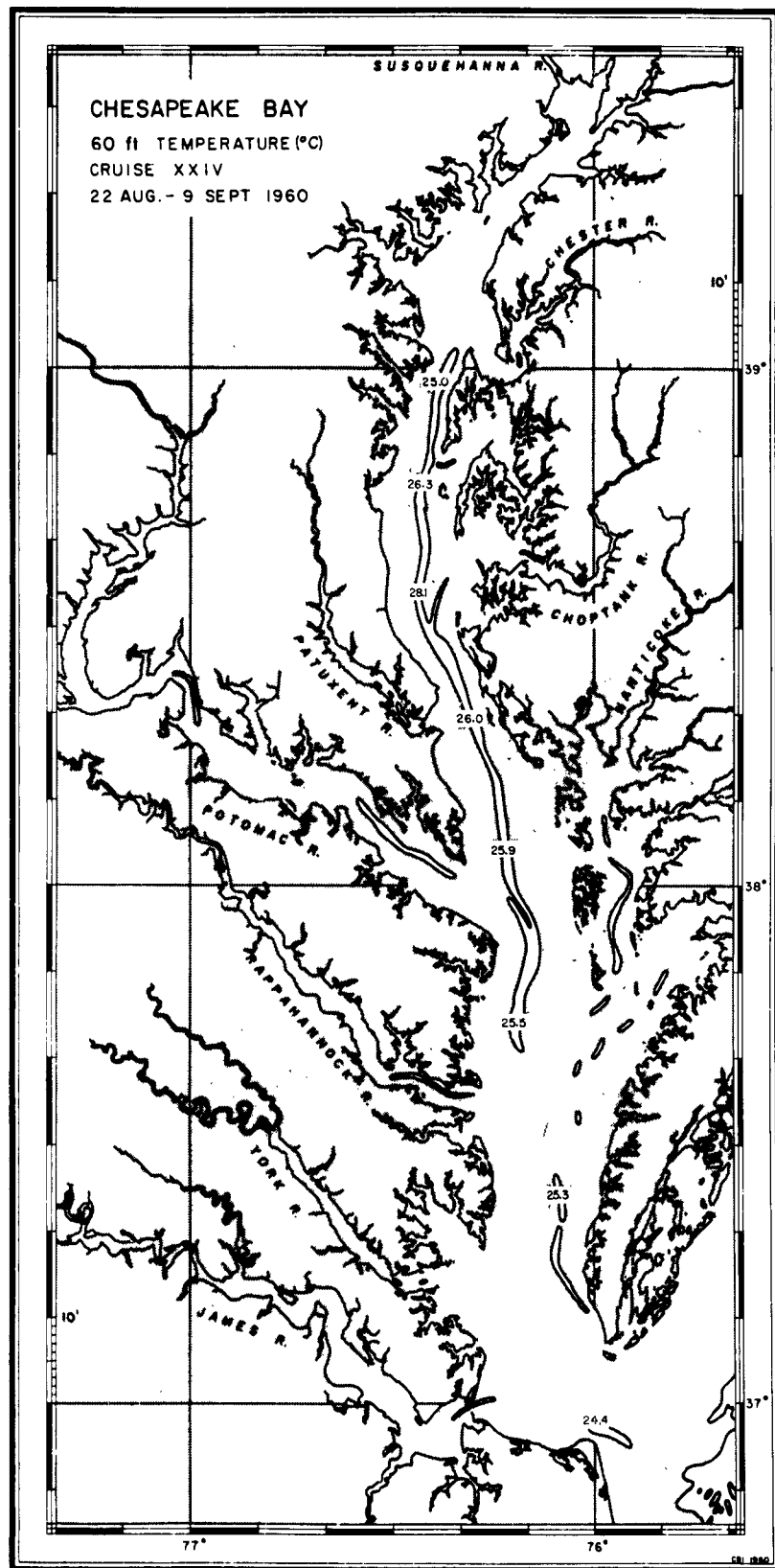




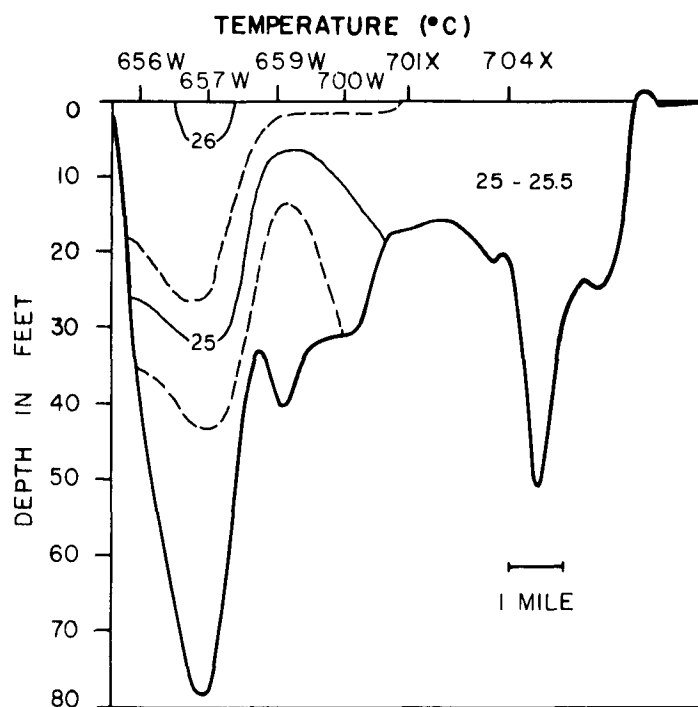
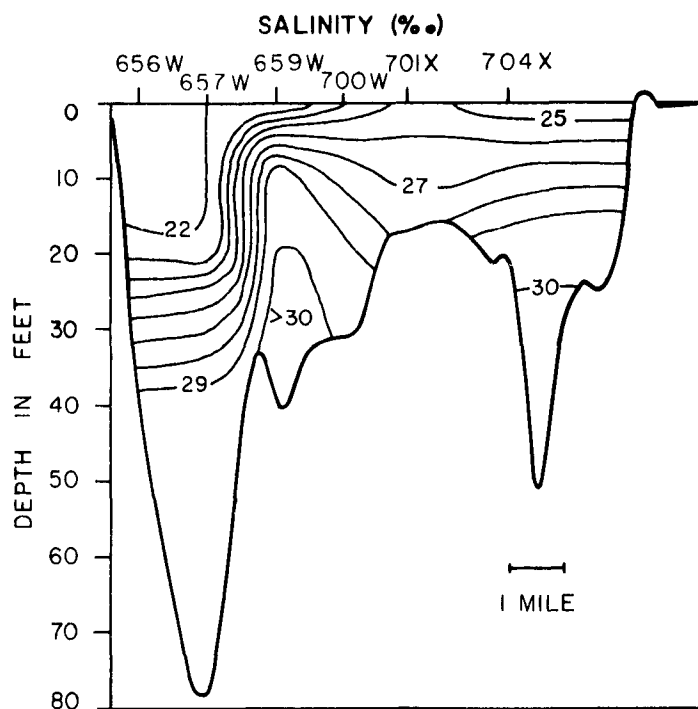




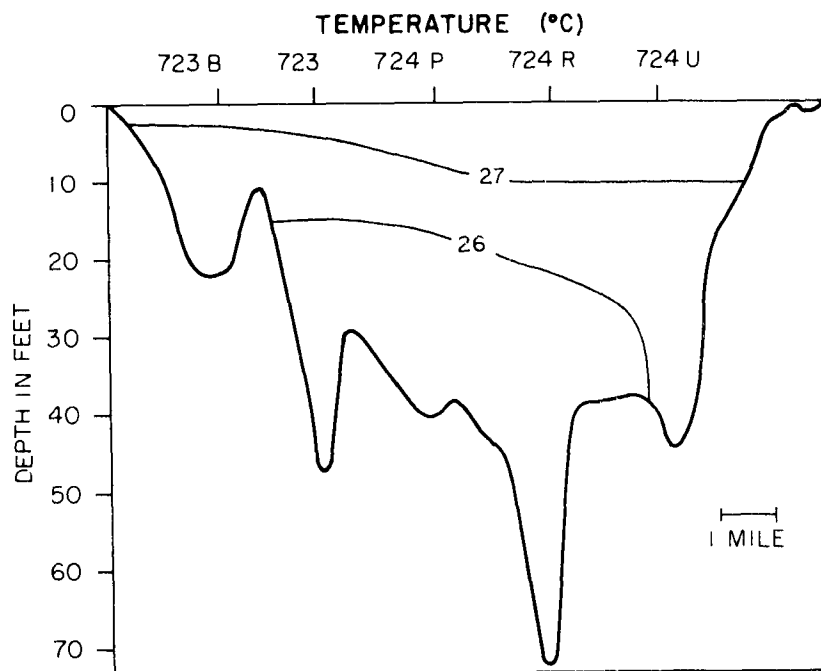
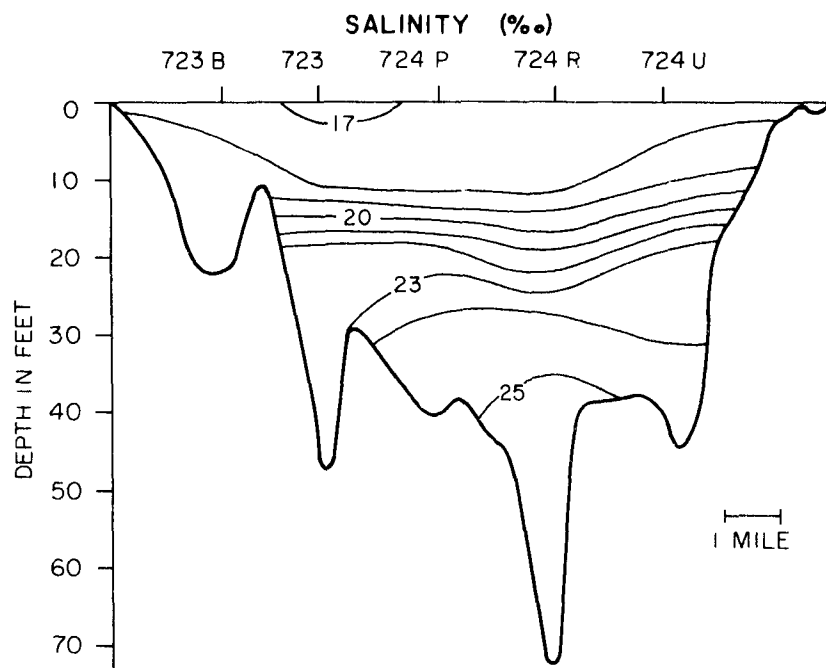




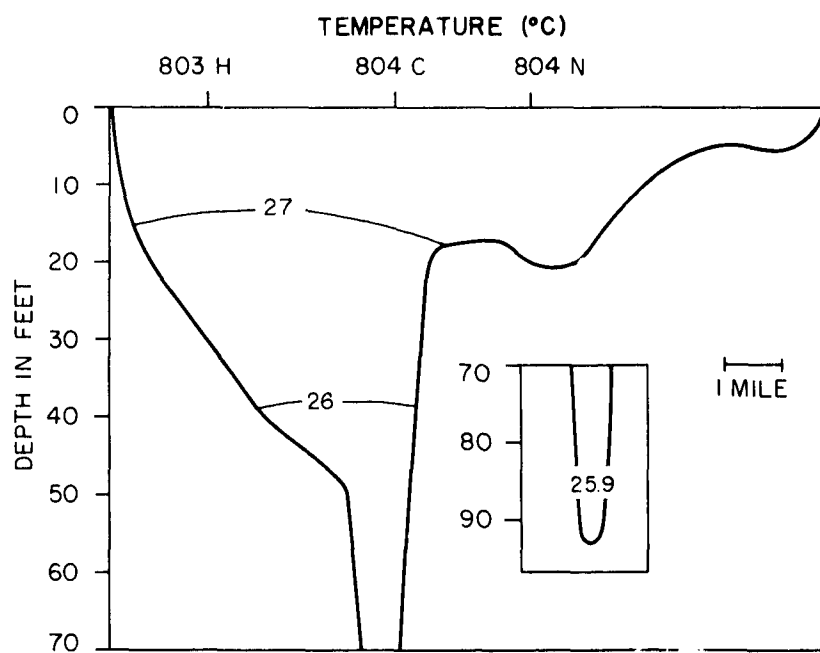
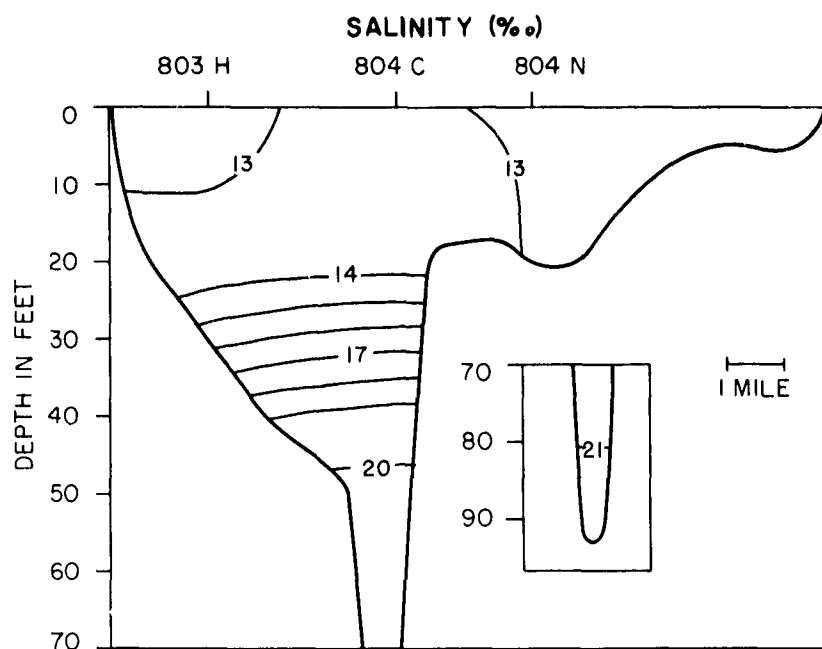
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION II



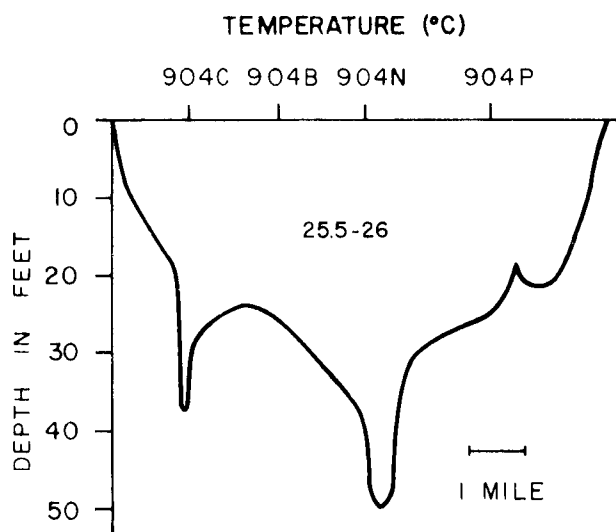
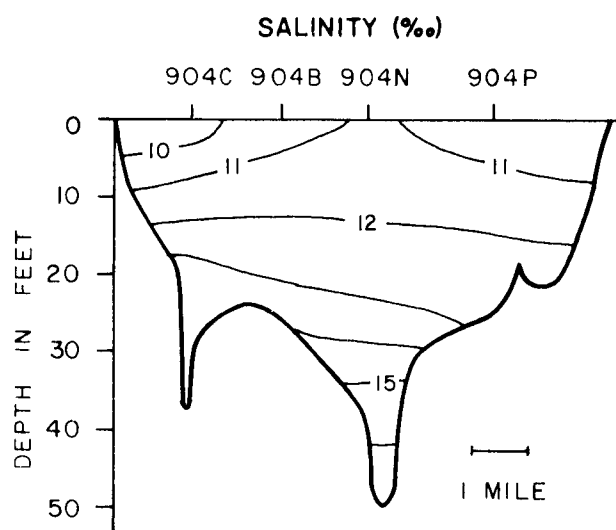
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION IV



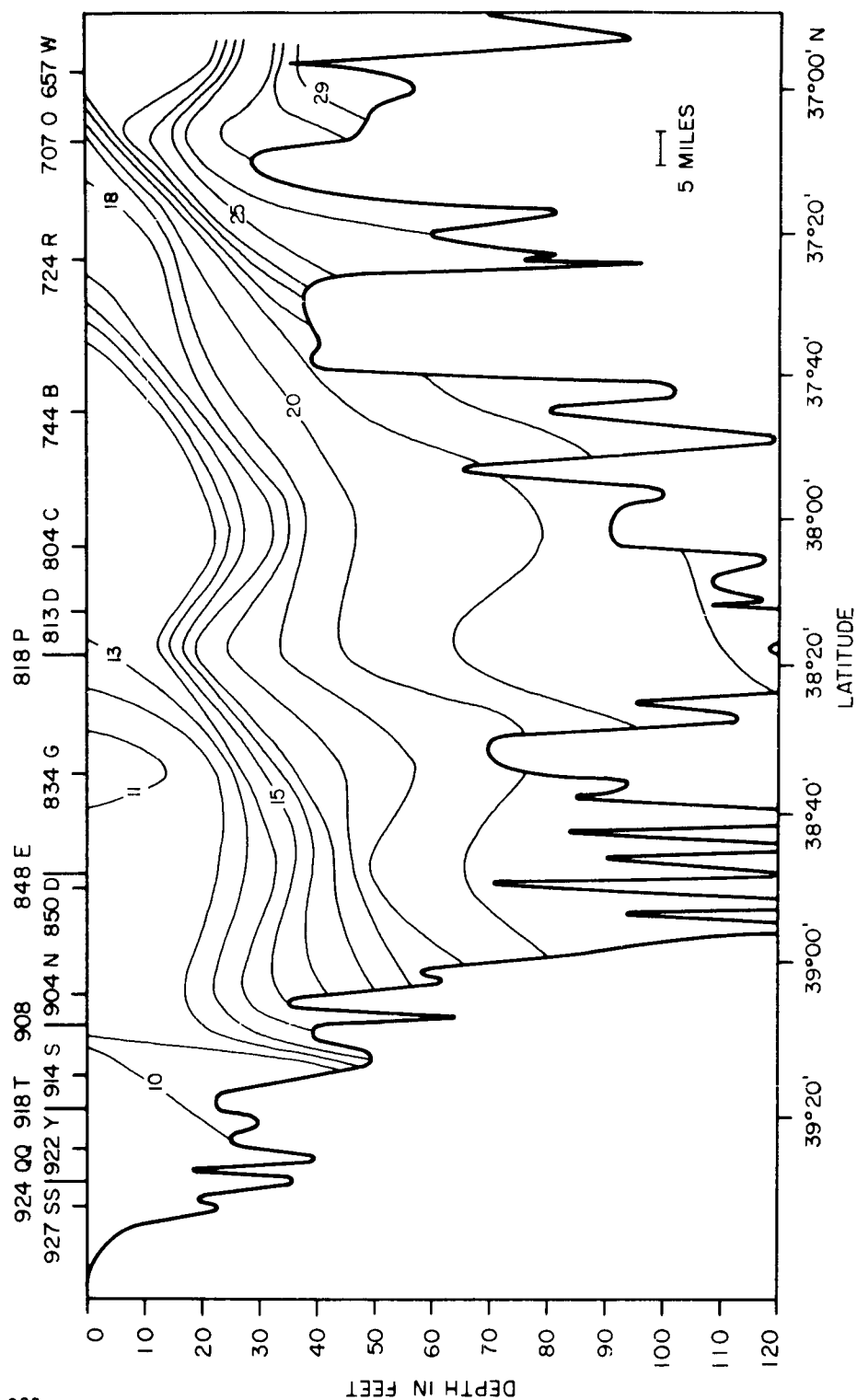
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION VI



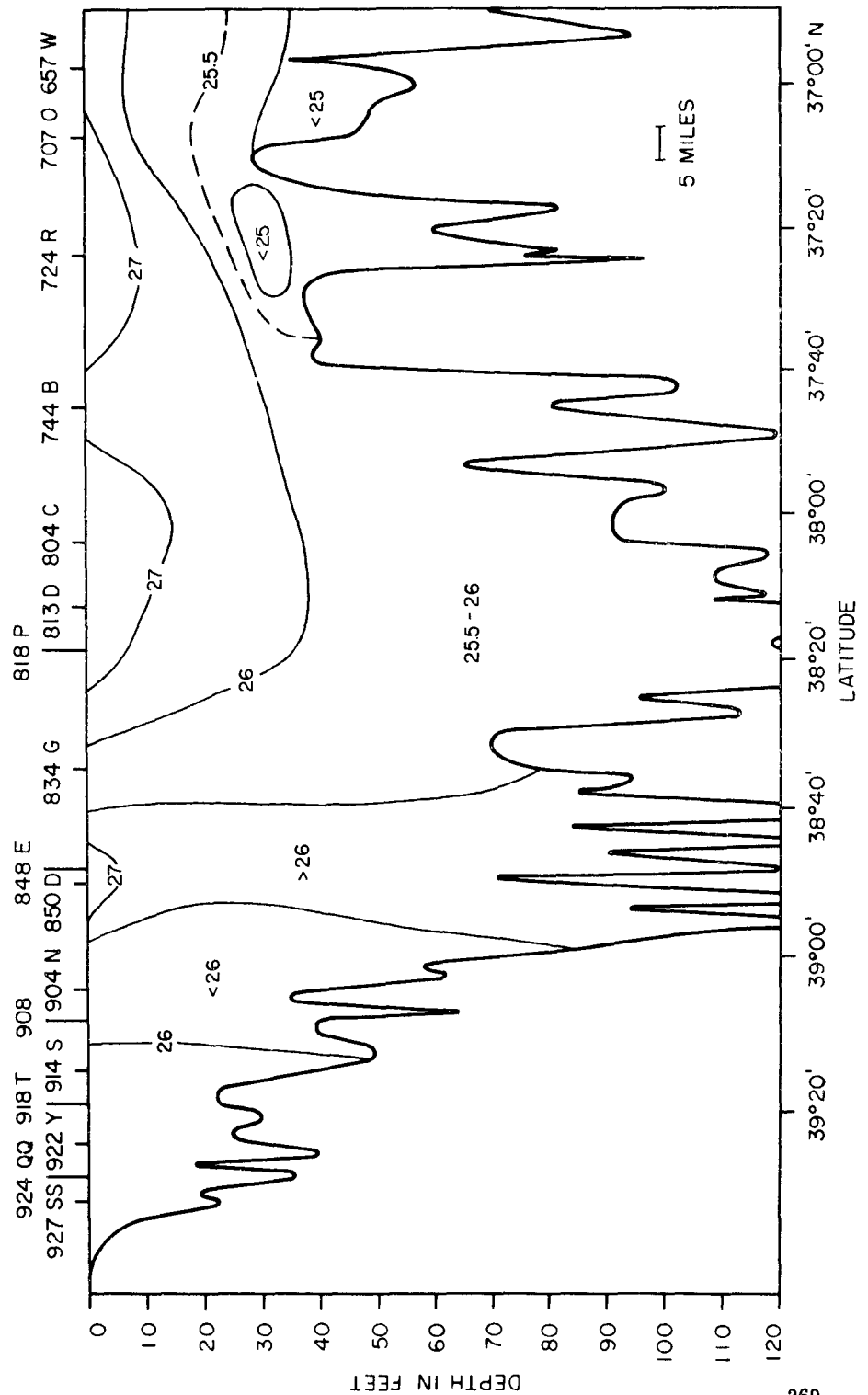
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION X

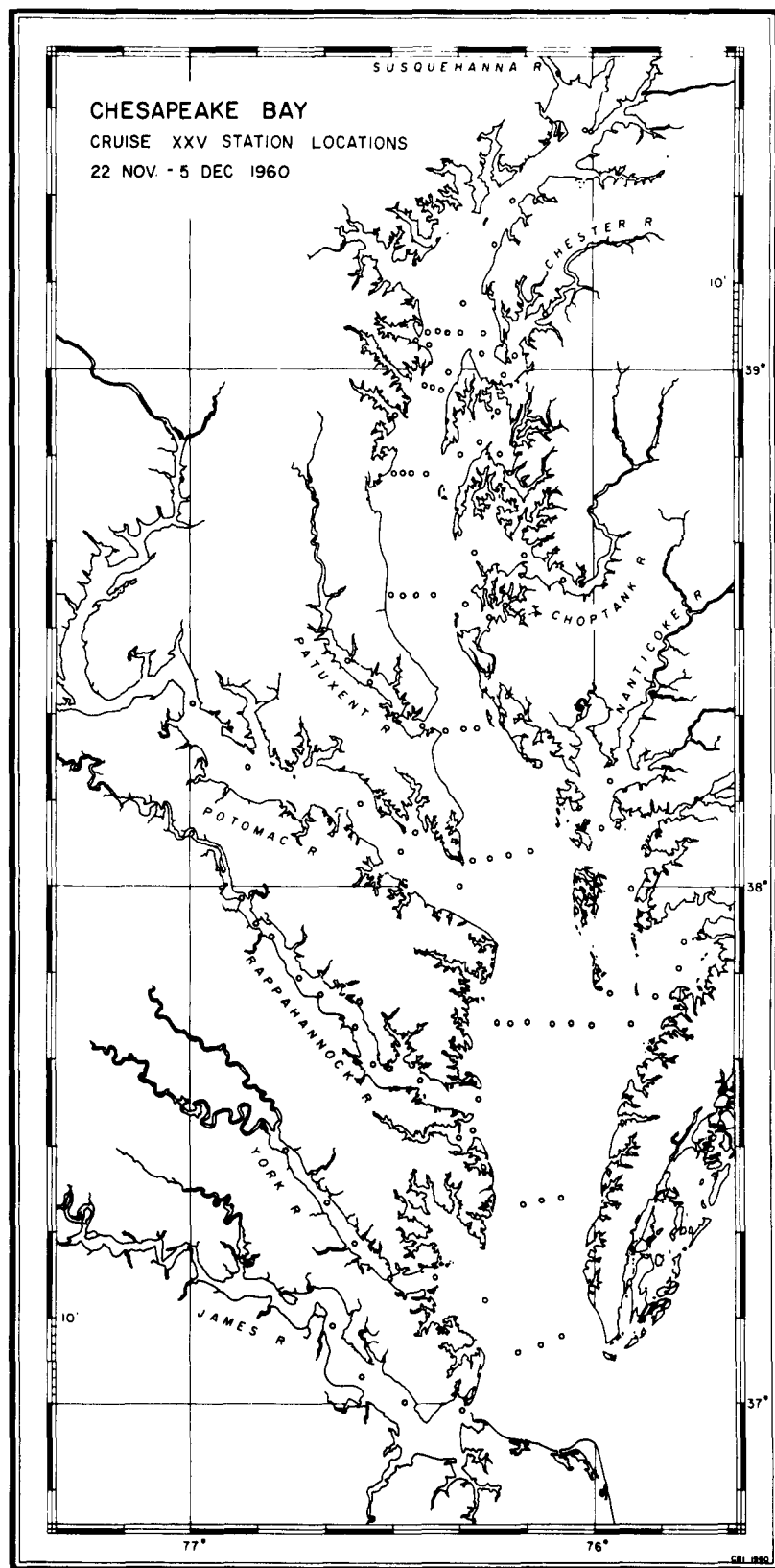


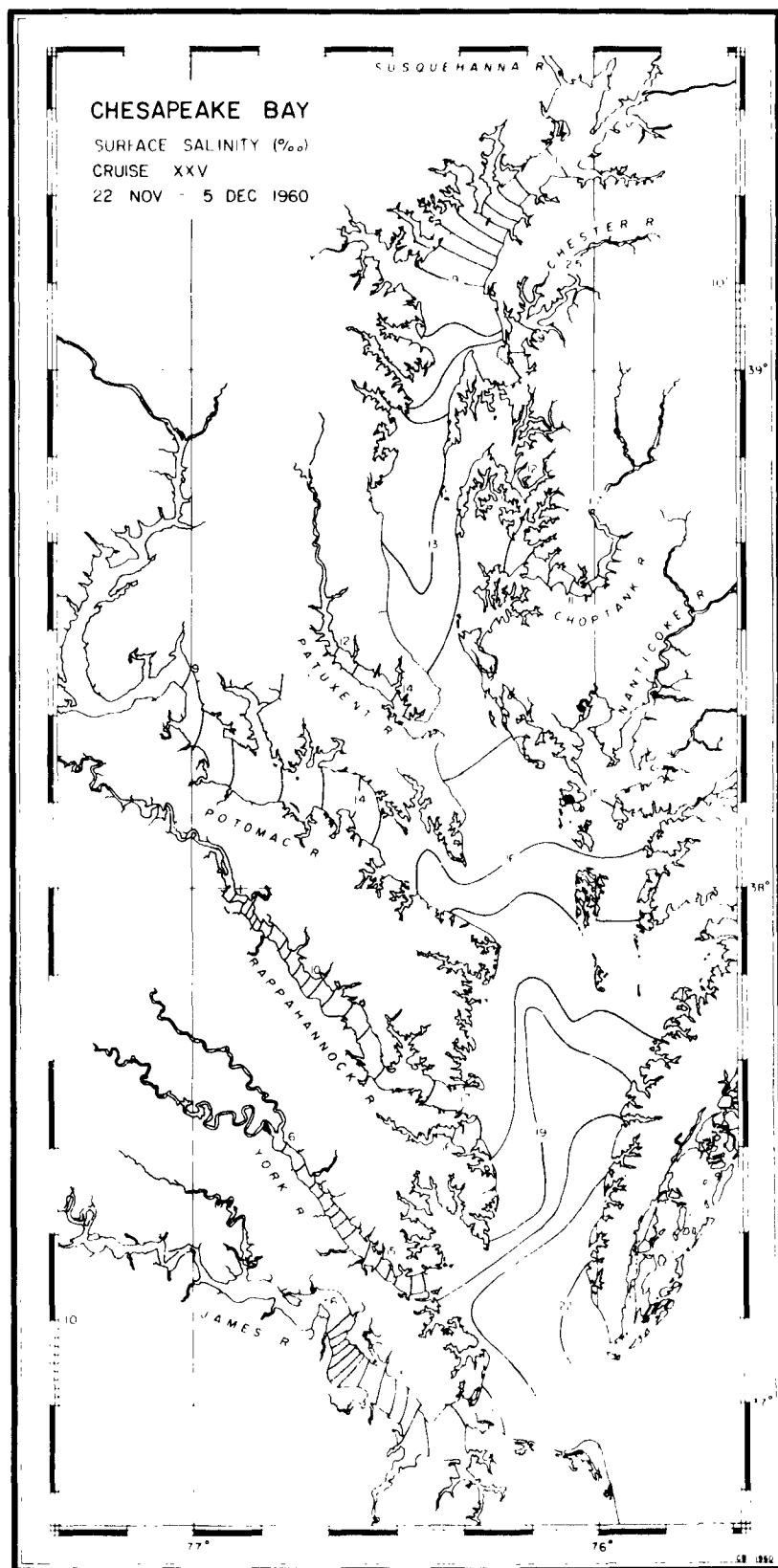
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION XIX
SALINITY (‰)

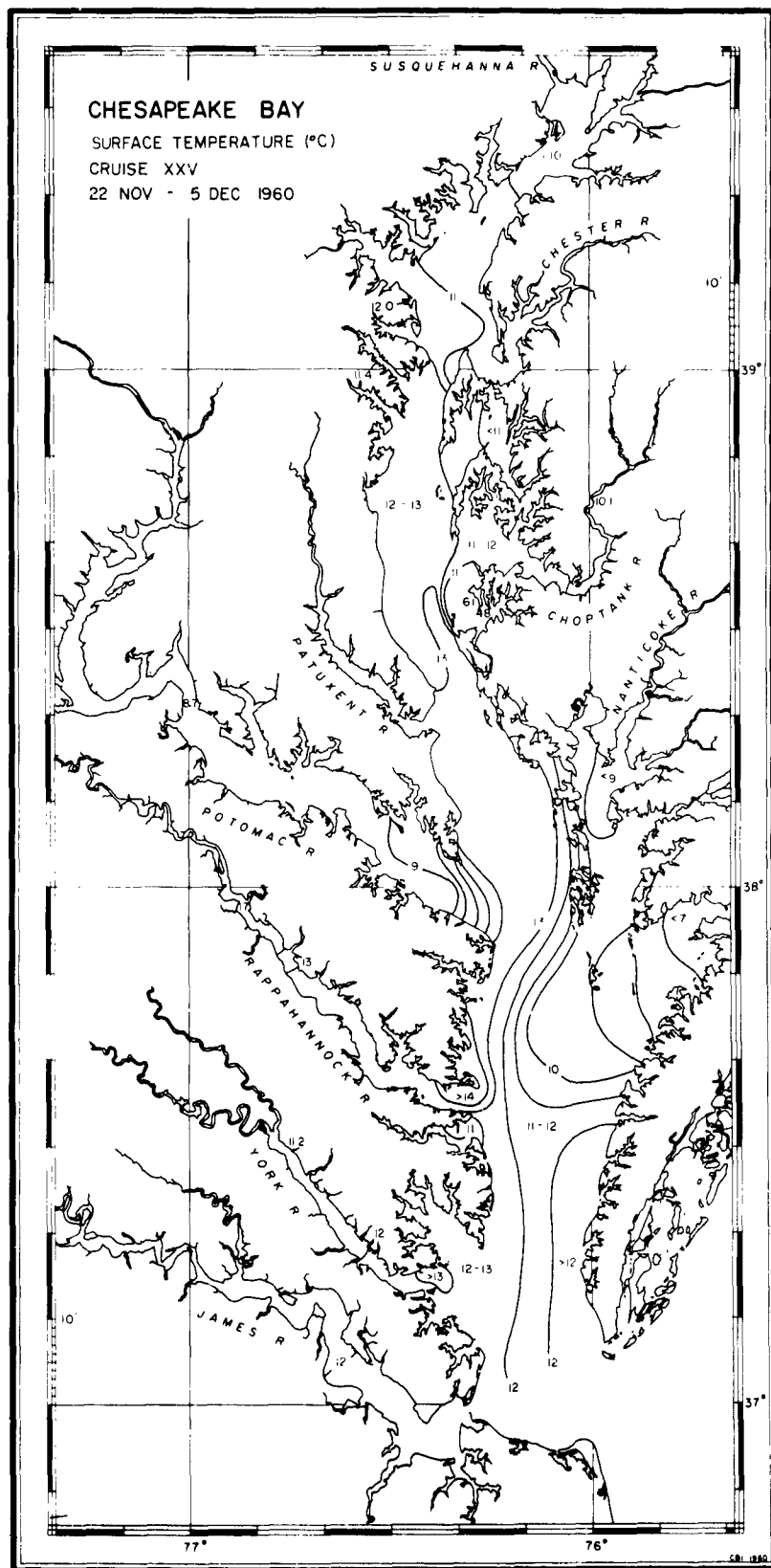


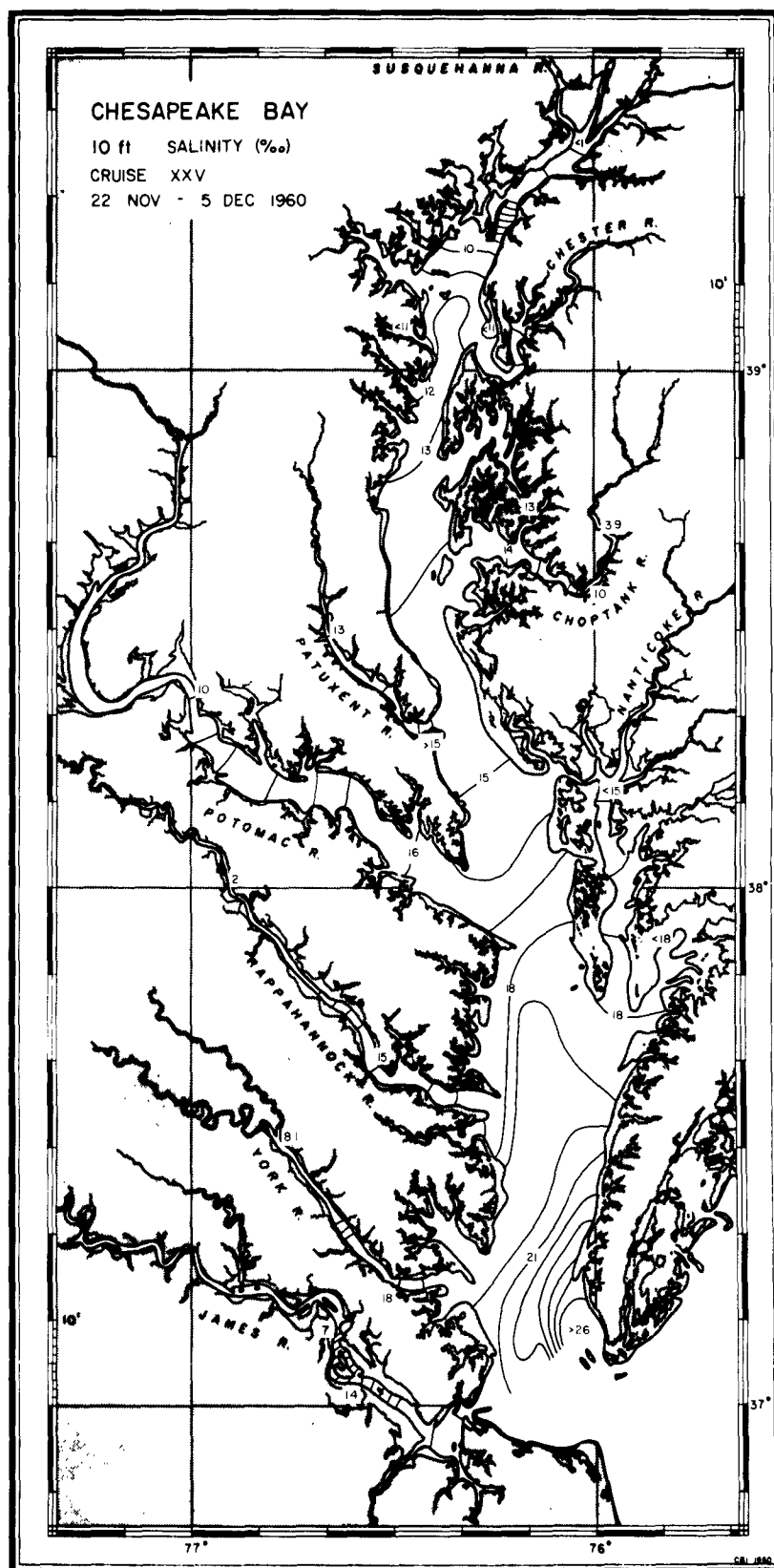
CRUISE XXIV 22 AUG - 9 SEPT 1960 SECTION XIX
TEMPERATURE (°C)

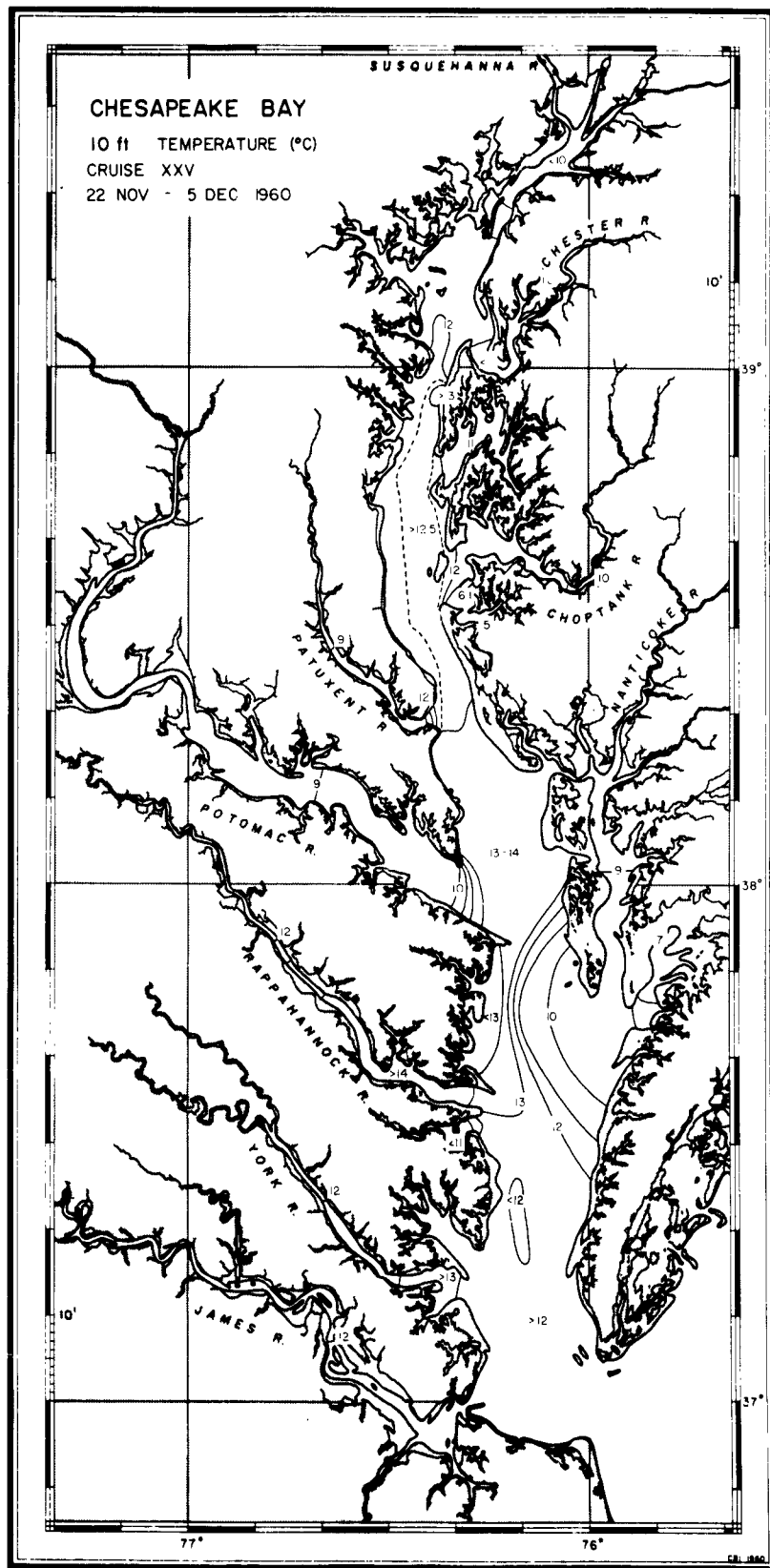


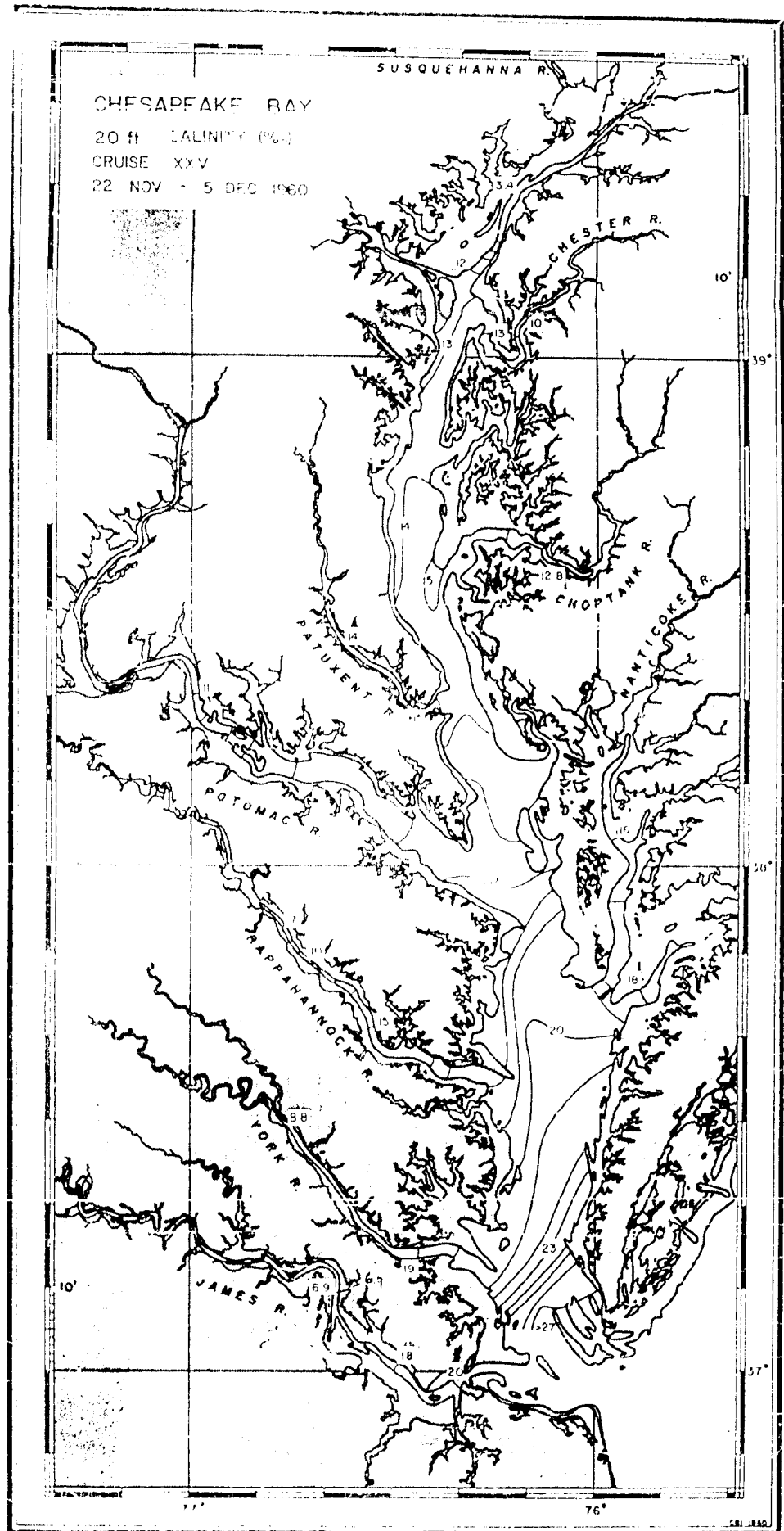


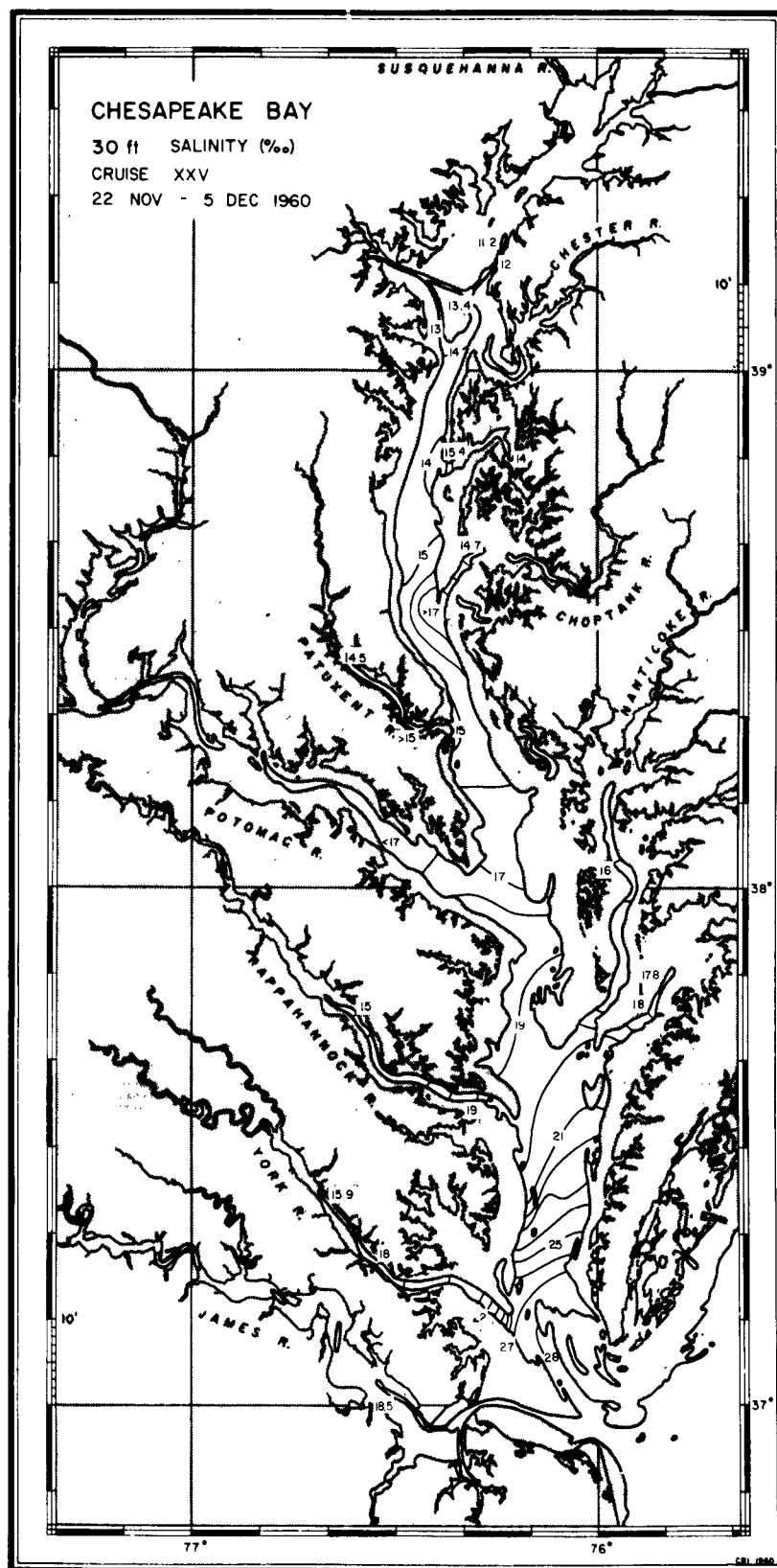


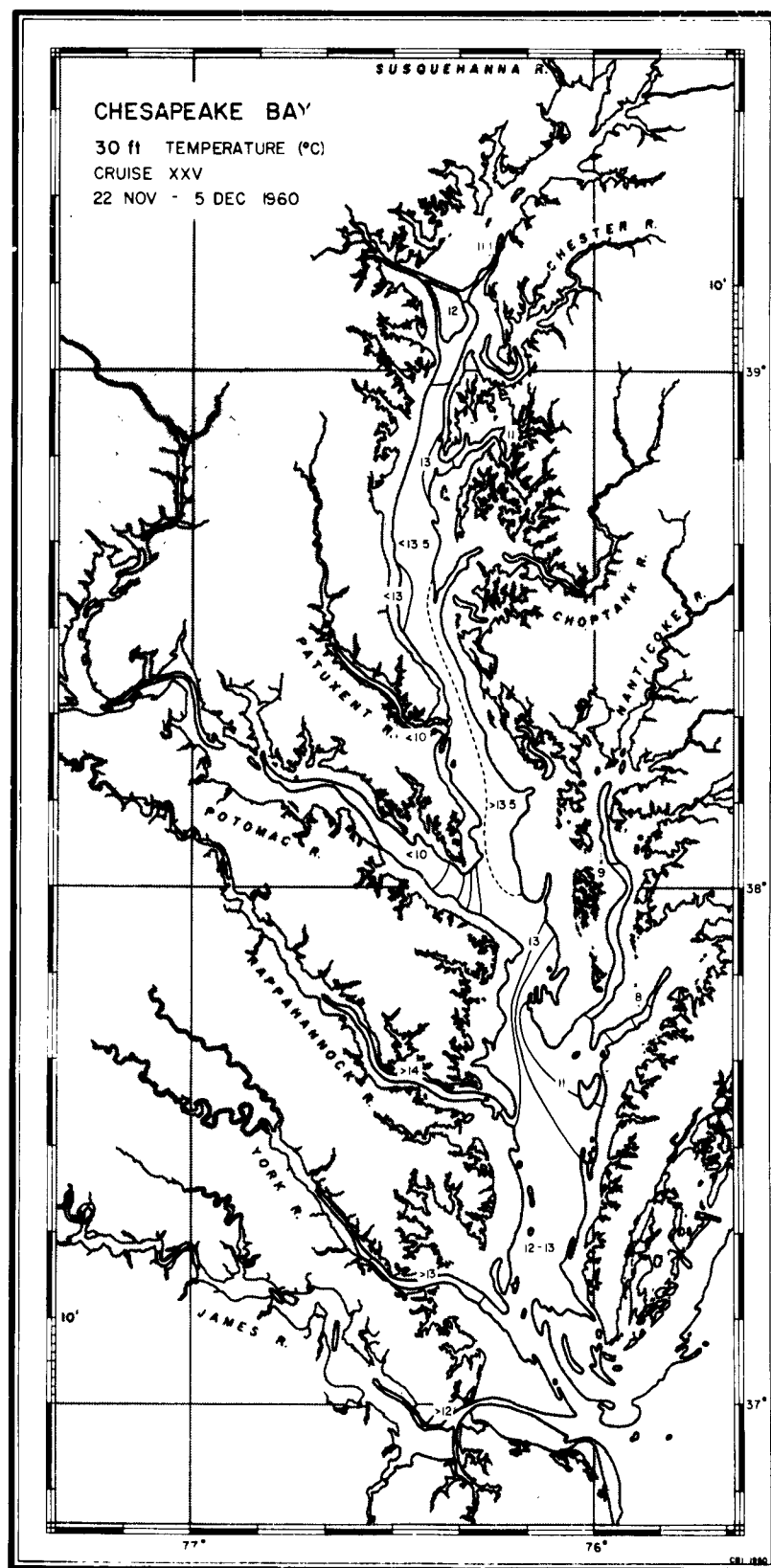


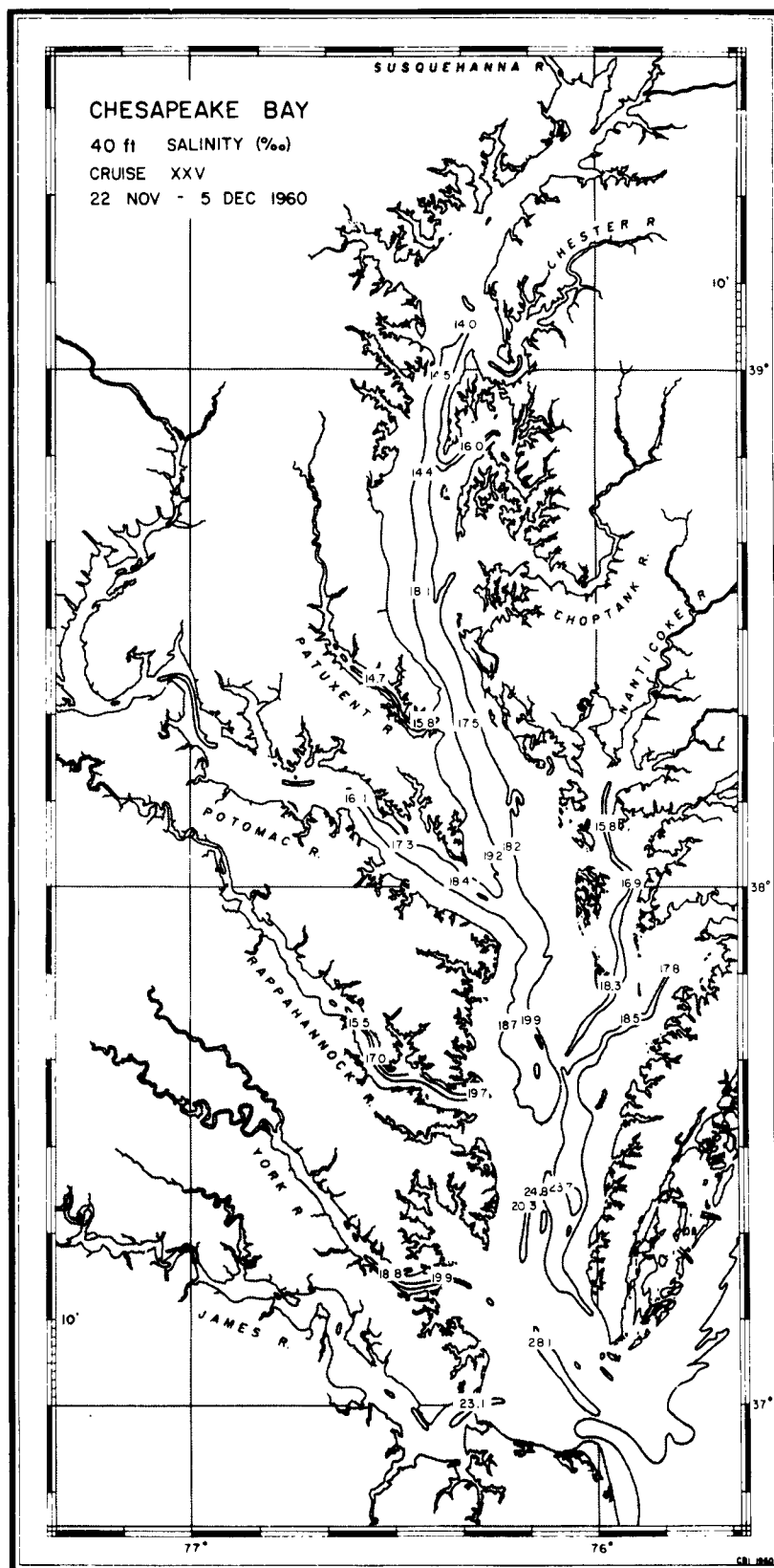


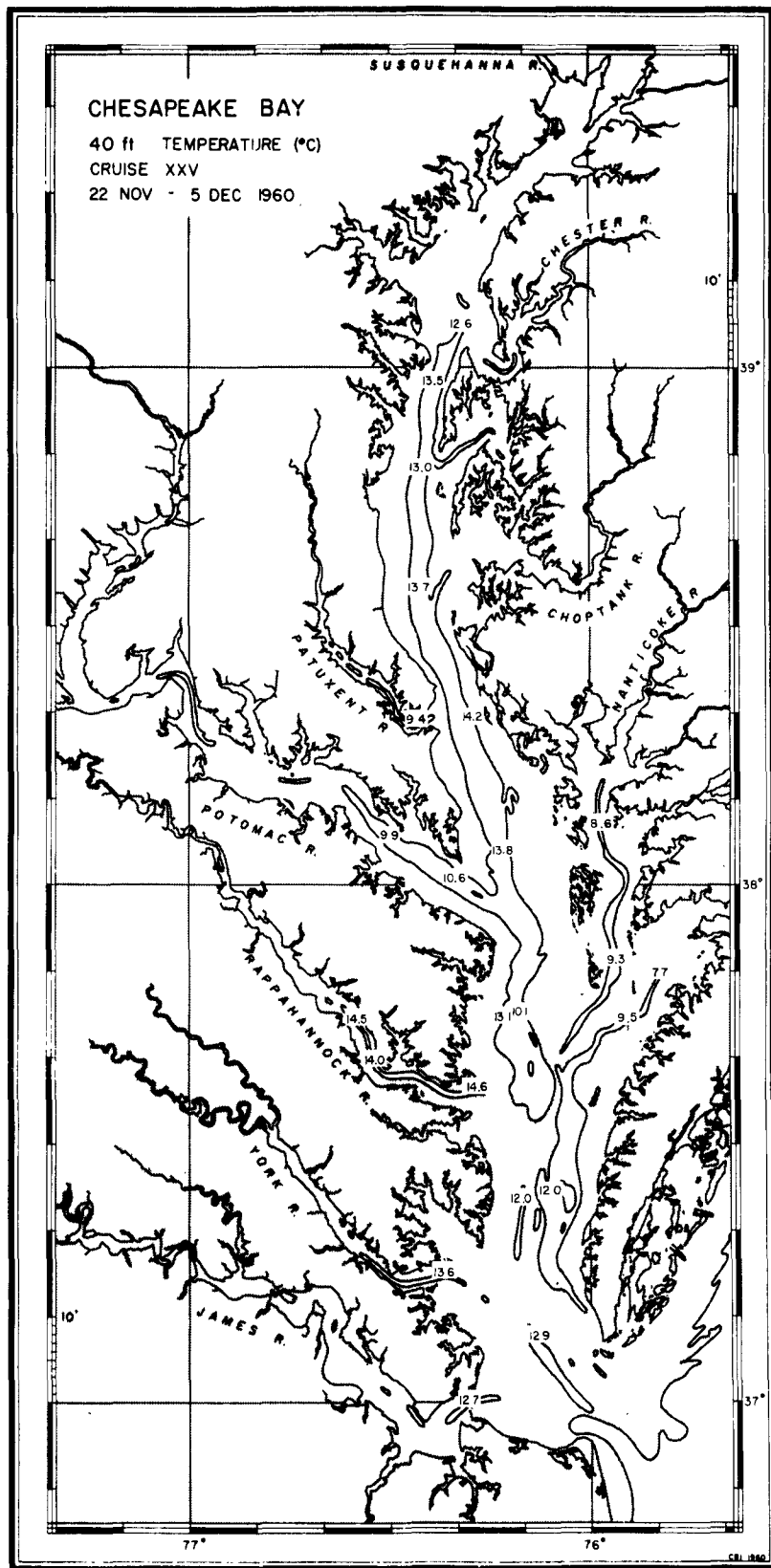


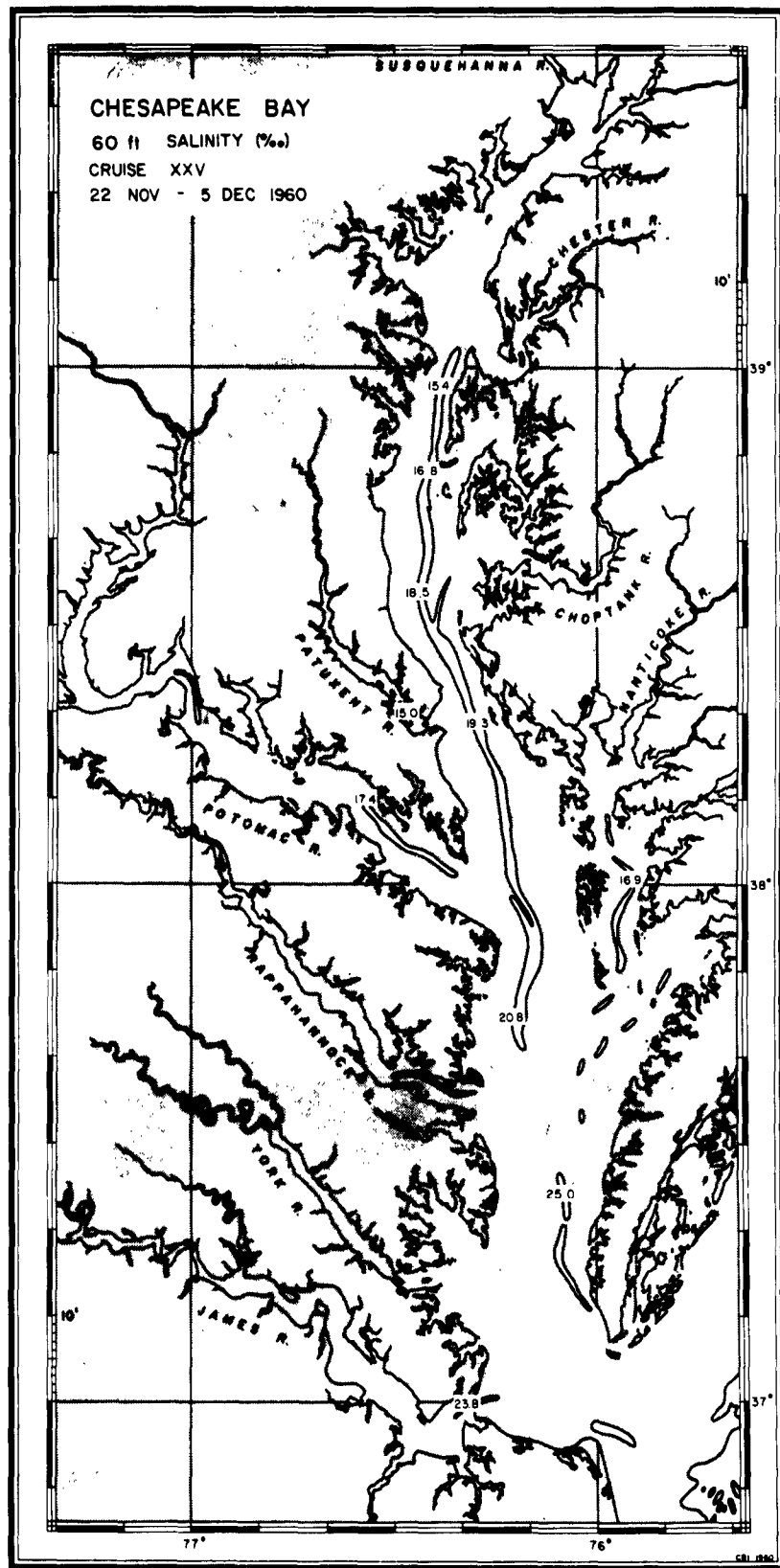






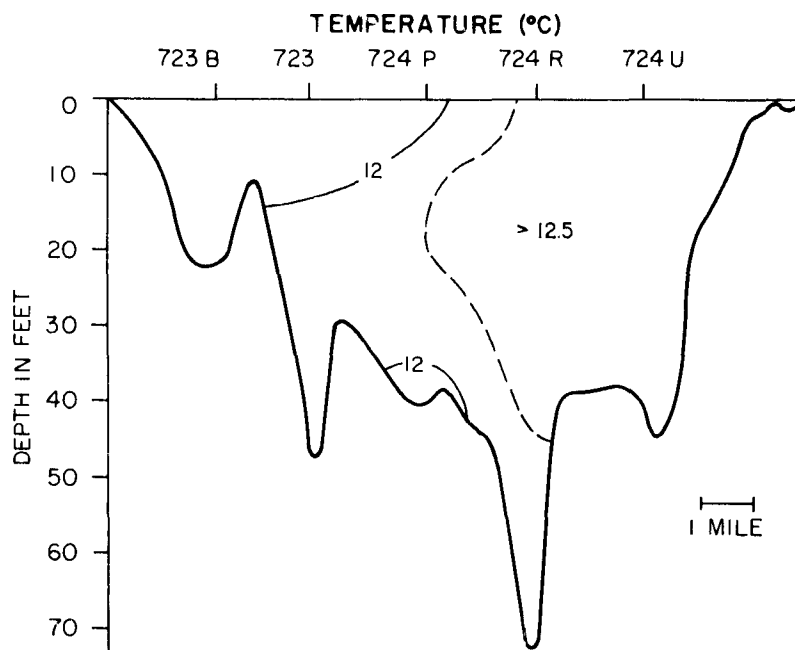
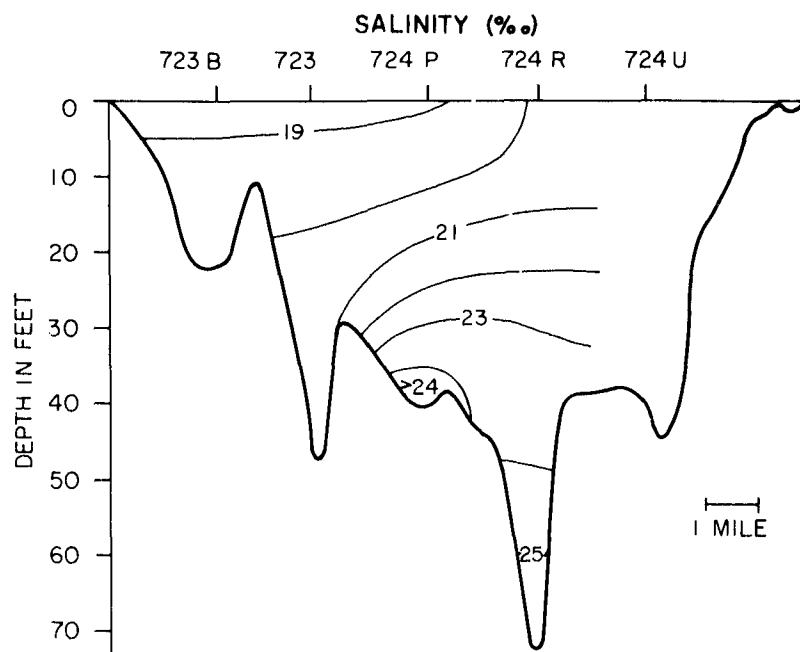




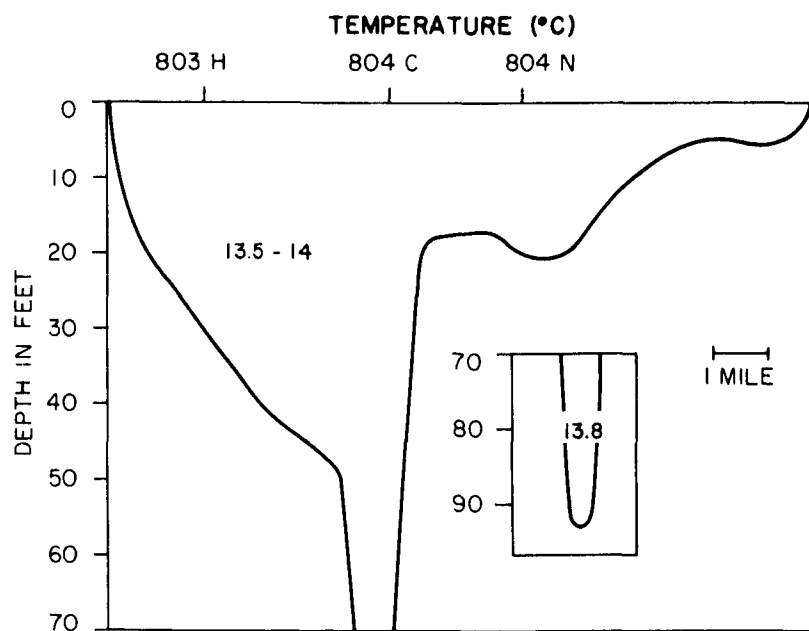
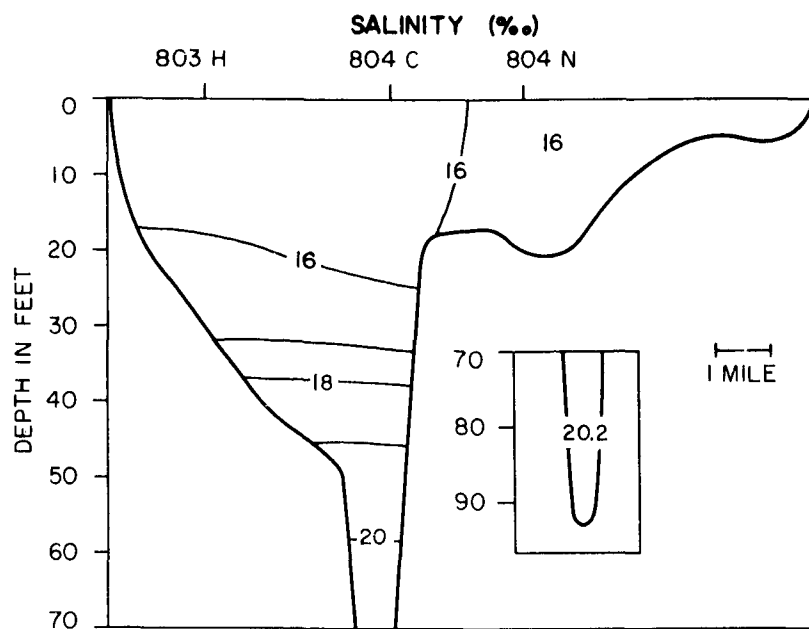


SECTION OMITTED
INSUFFICIENT DATA

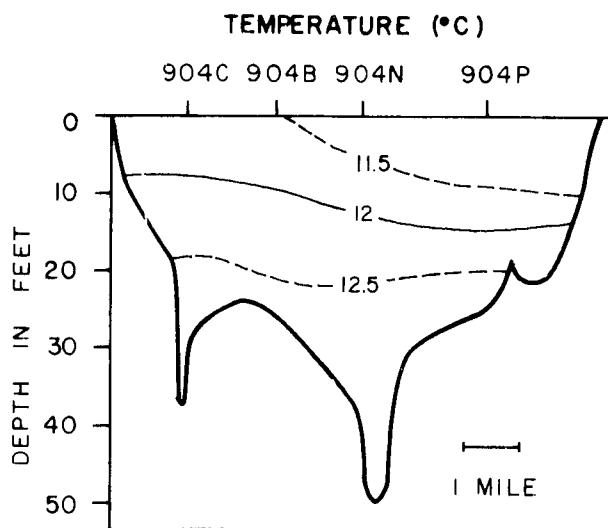
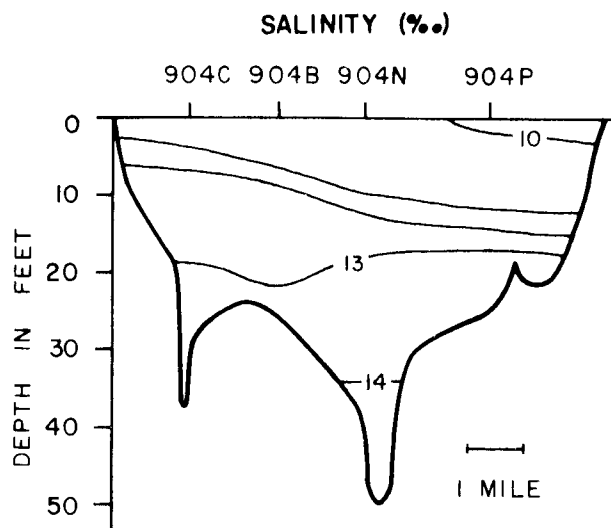
CRUISE XXV 22 NOV - 5 DEC 1960 SECTION IV



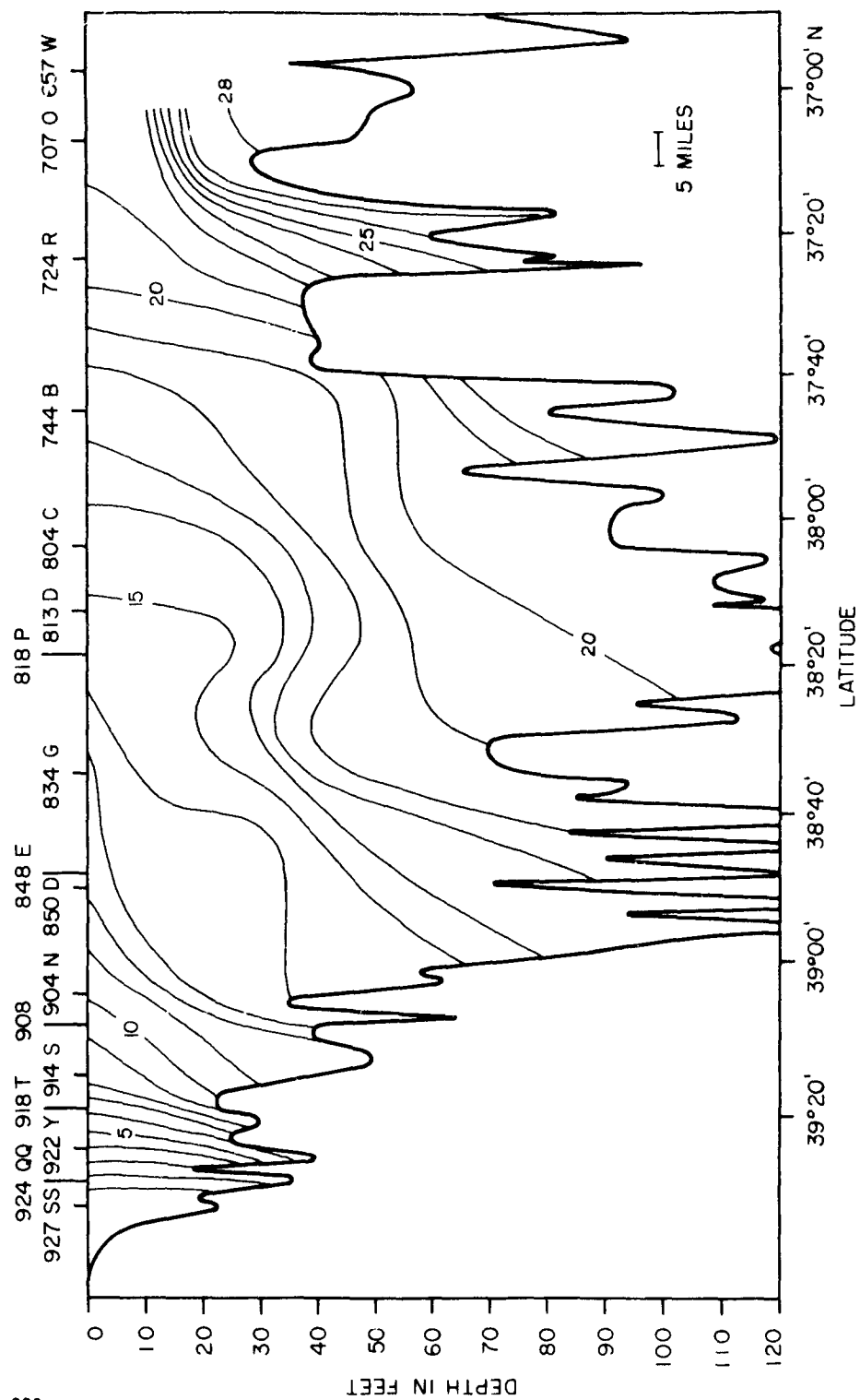
CRUISE XXV 22 NOV - 5 DEC 1960 SECTION VI



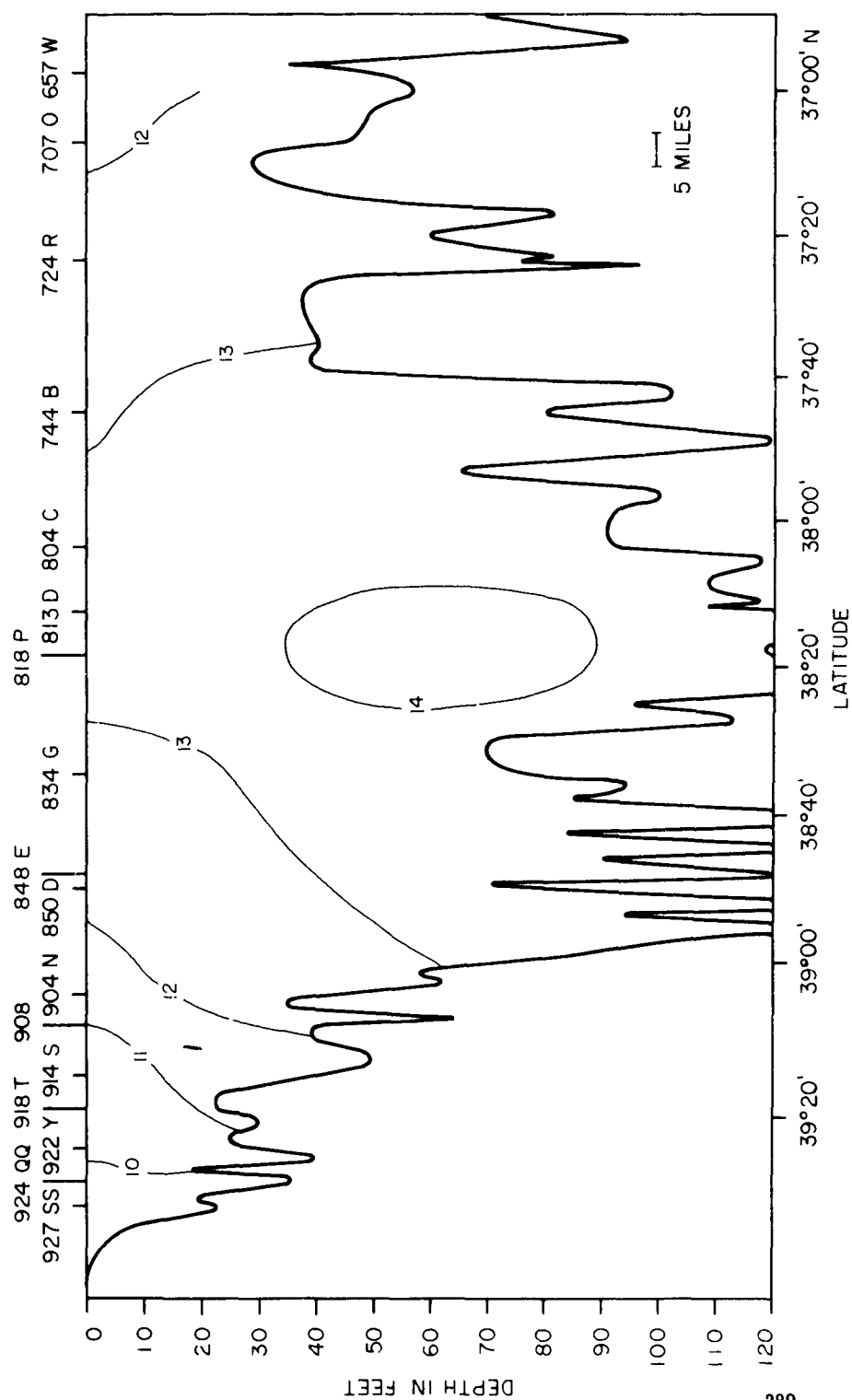
CRUISE XXV 22 NOV - 5 DEC 1960 SECTION X

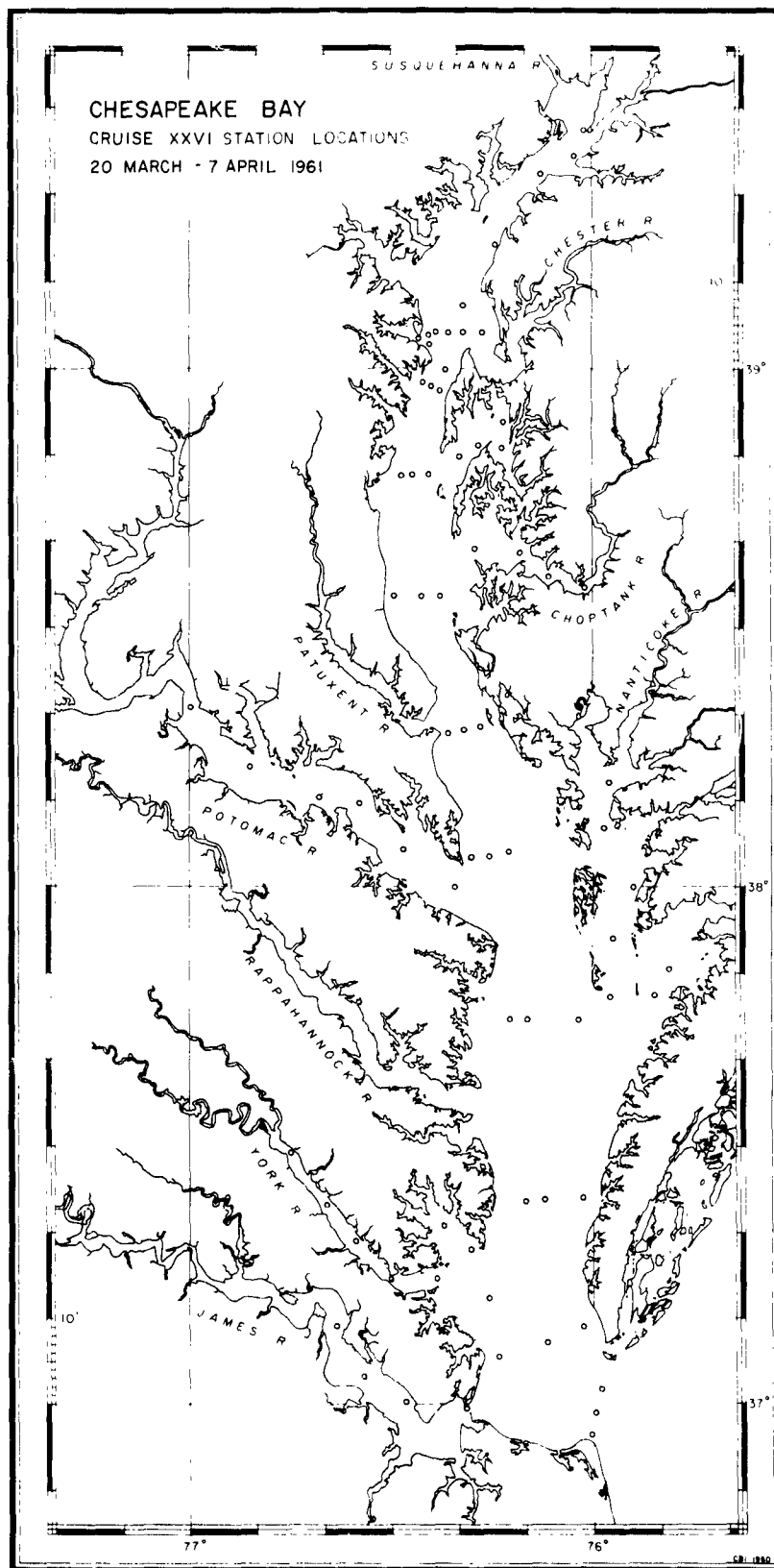


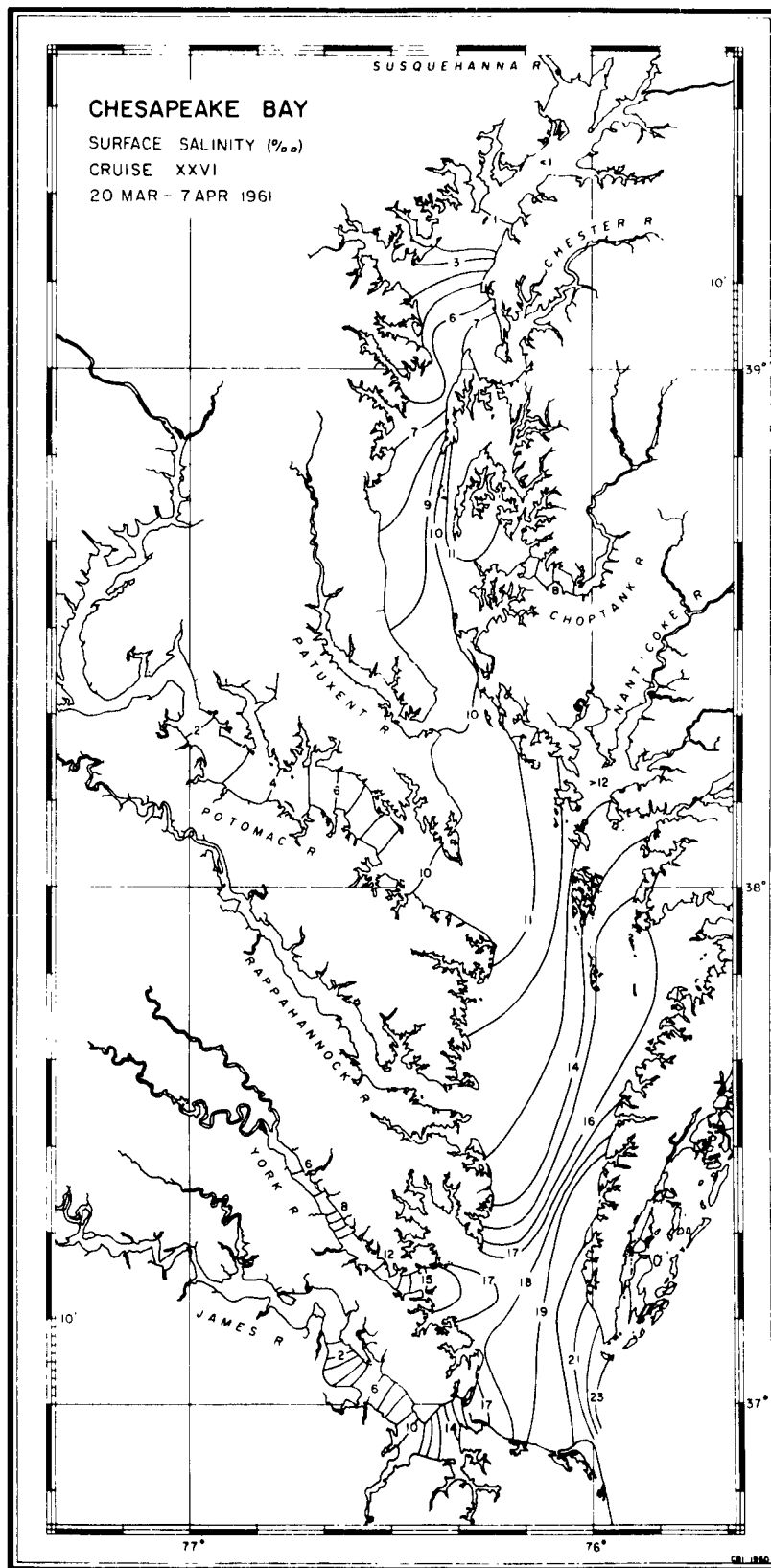
CRUISE XXV 22 NOV - 5 DEC 1960 SECTION XIX
SALINITY (‰)

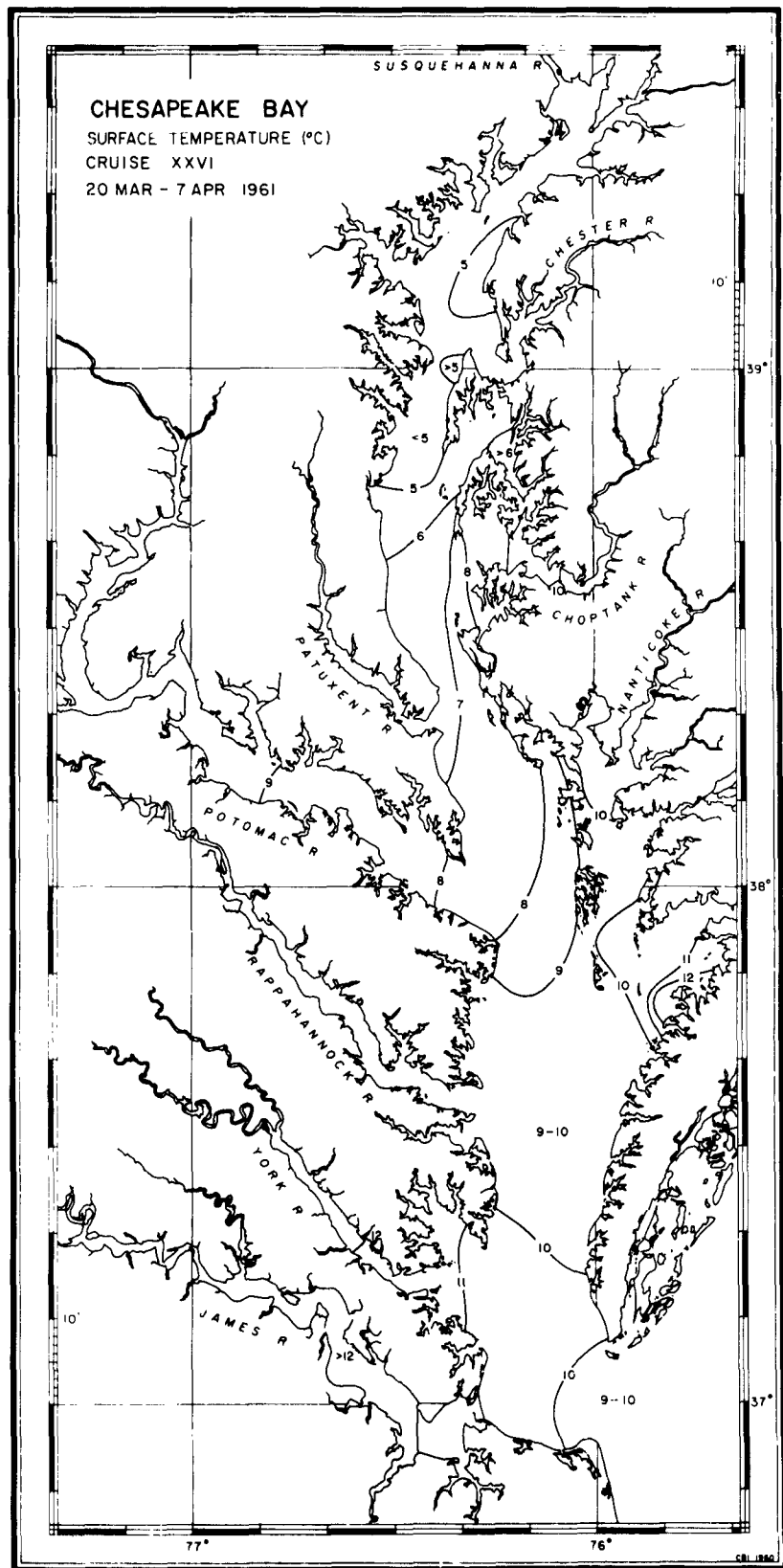


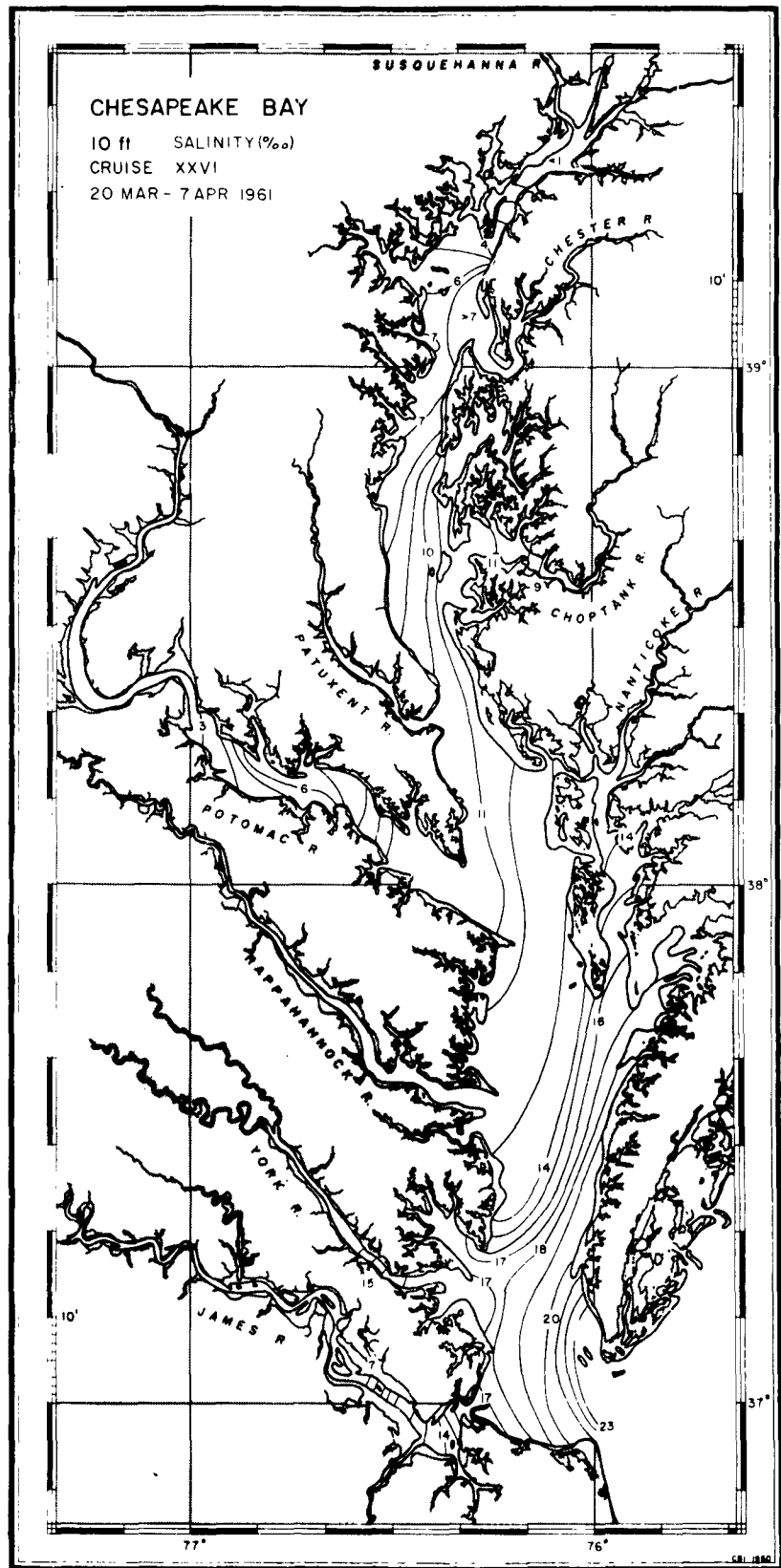
CRUISE XXV 22 NOV - 5 DEC 1960 SECTION XIX
TEMPERATURE (°C)

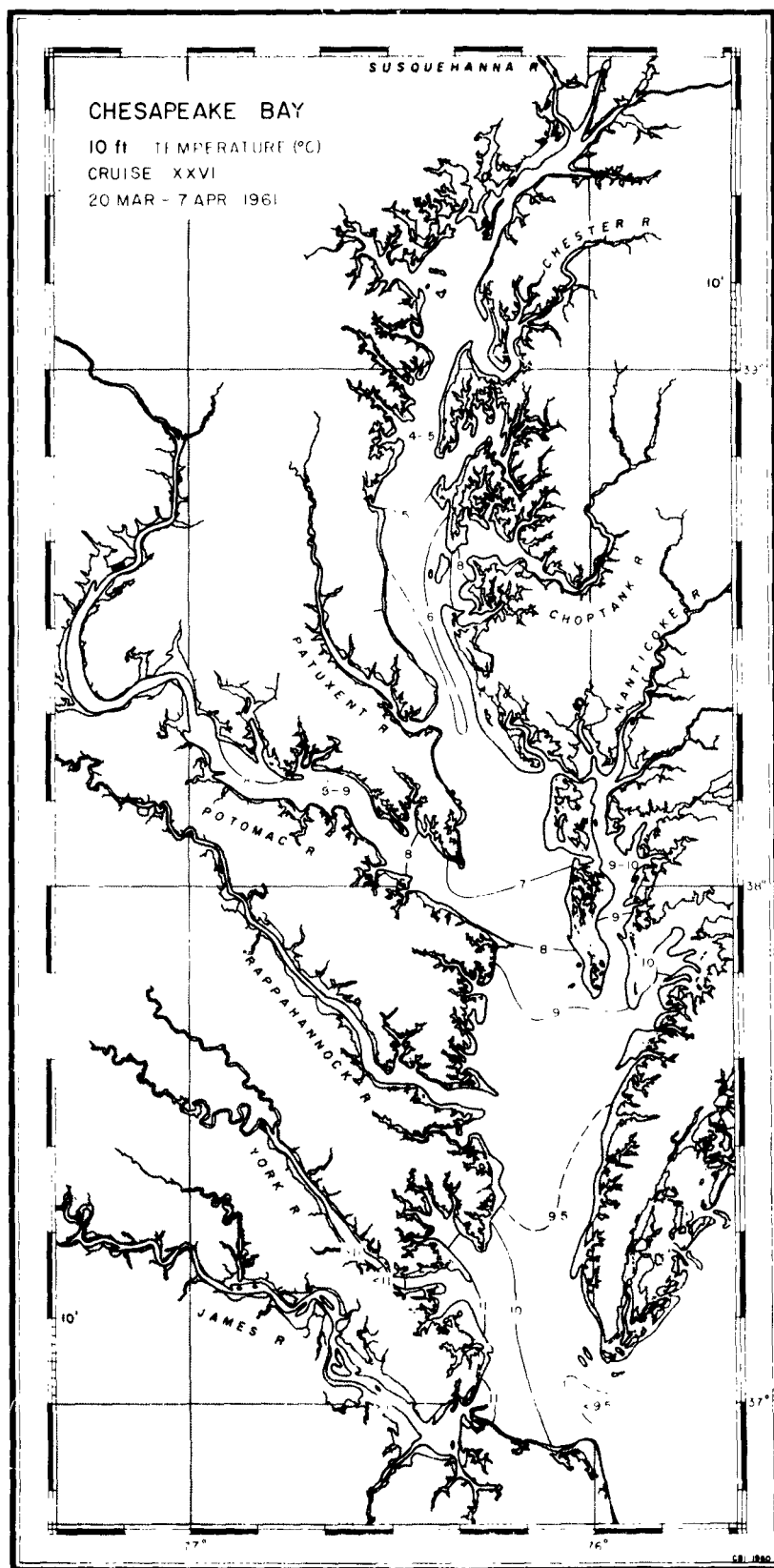


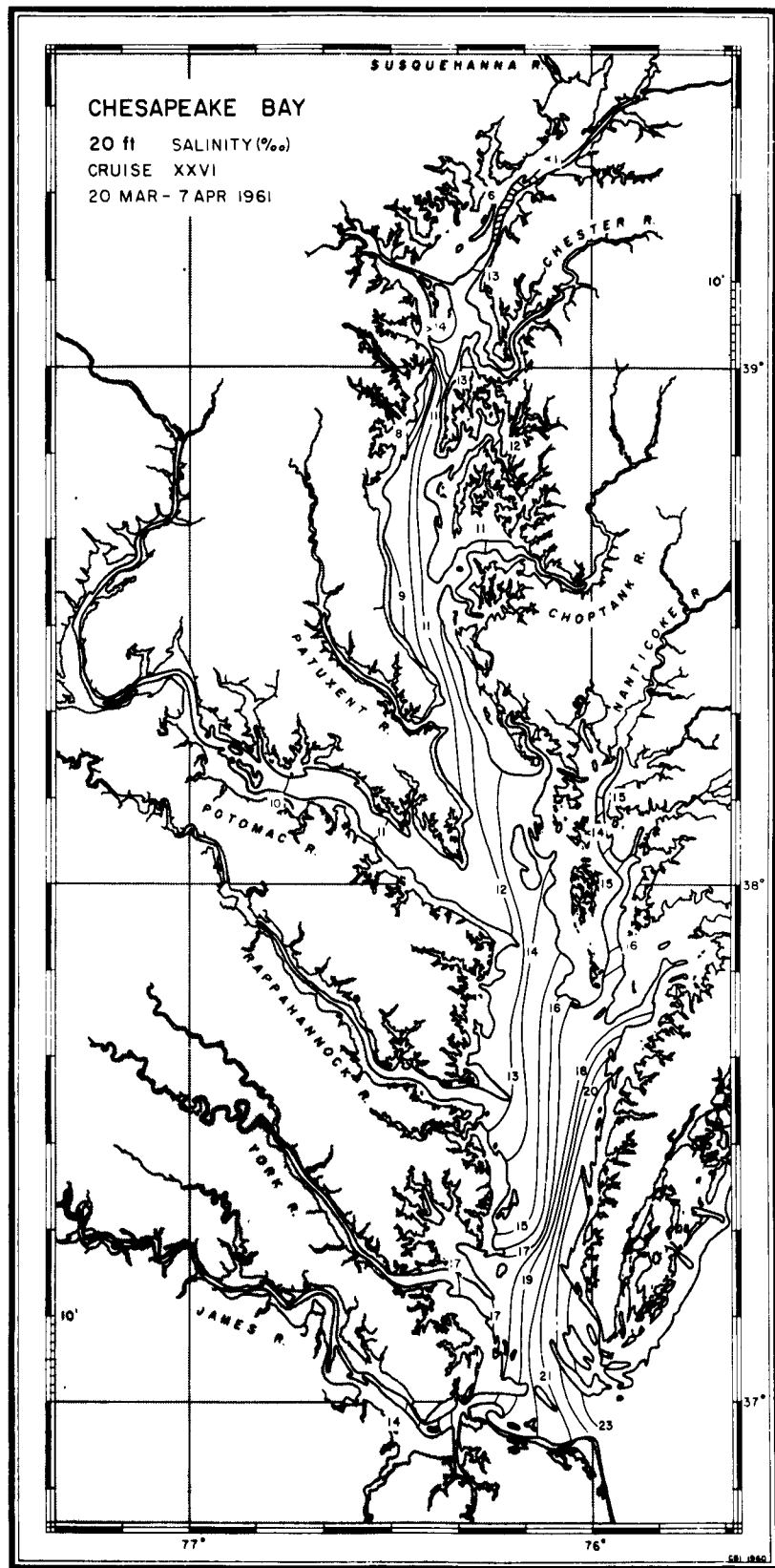


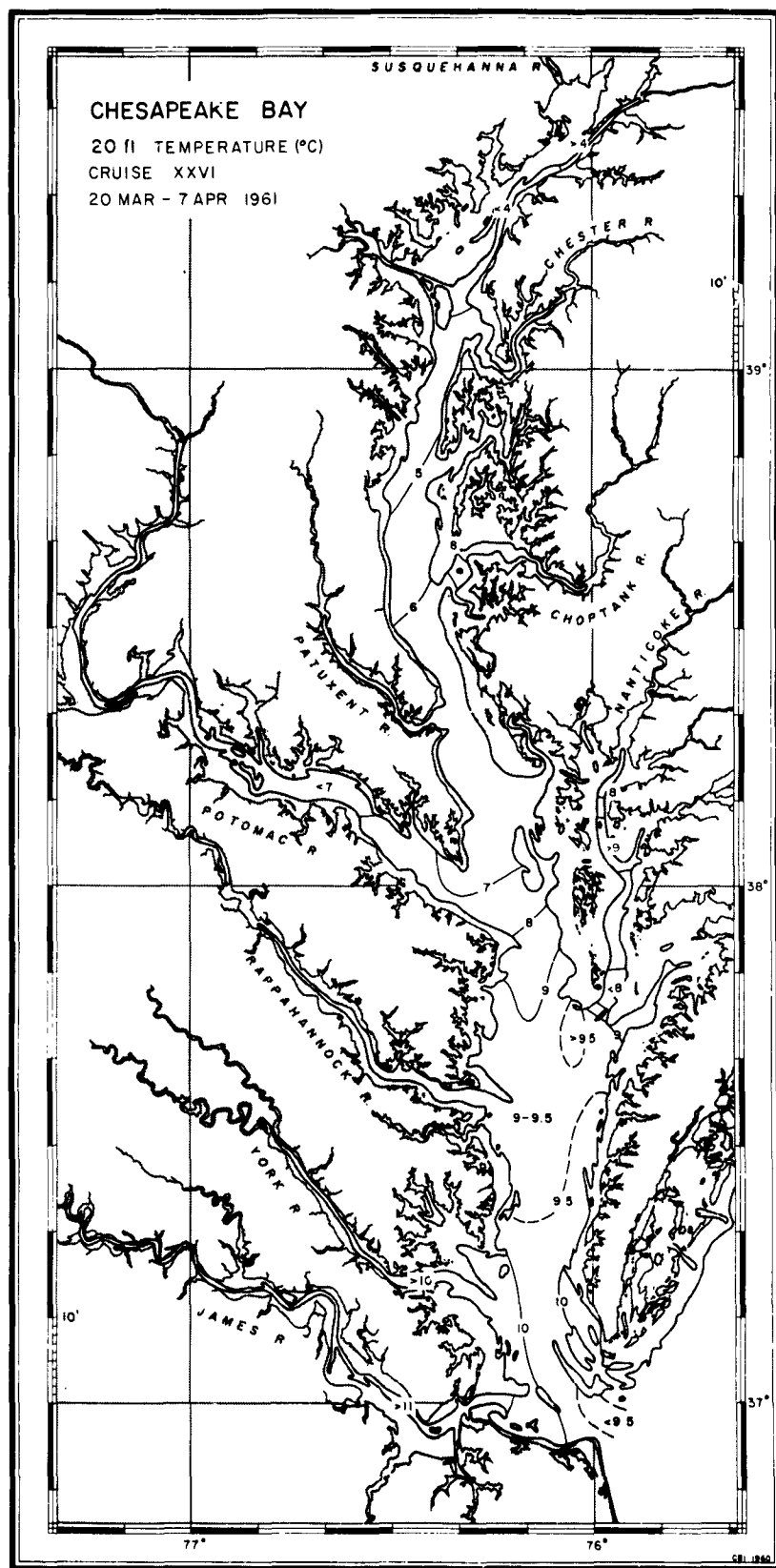


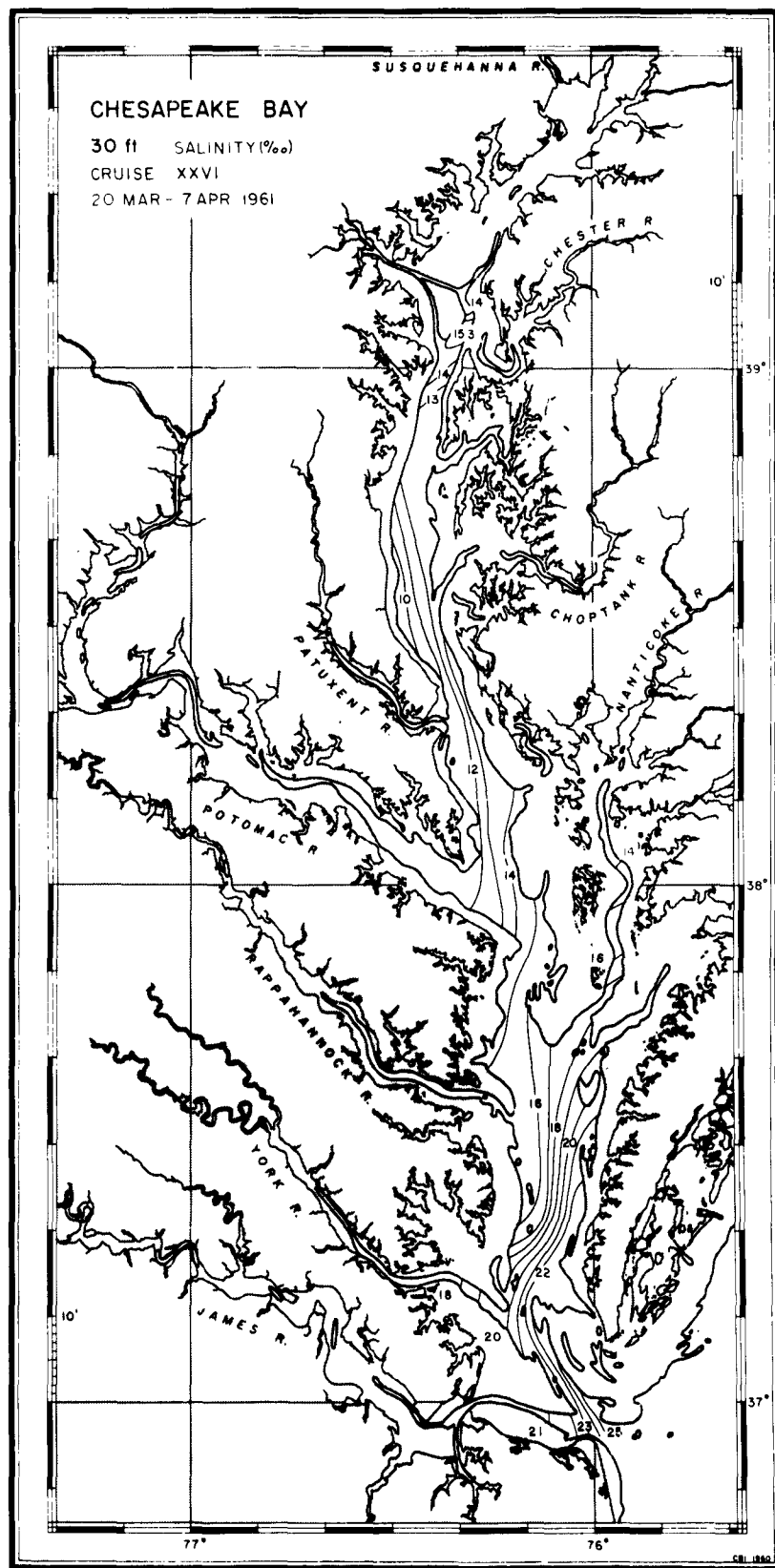


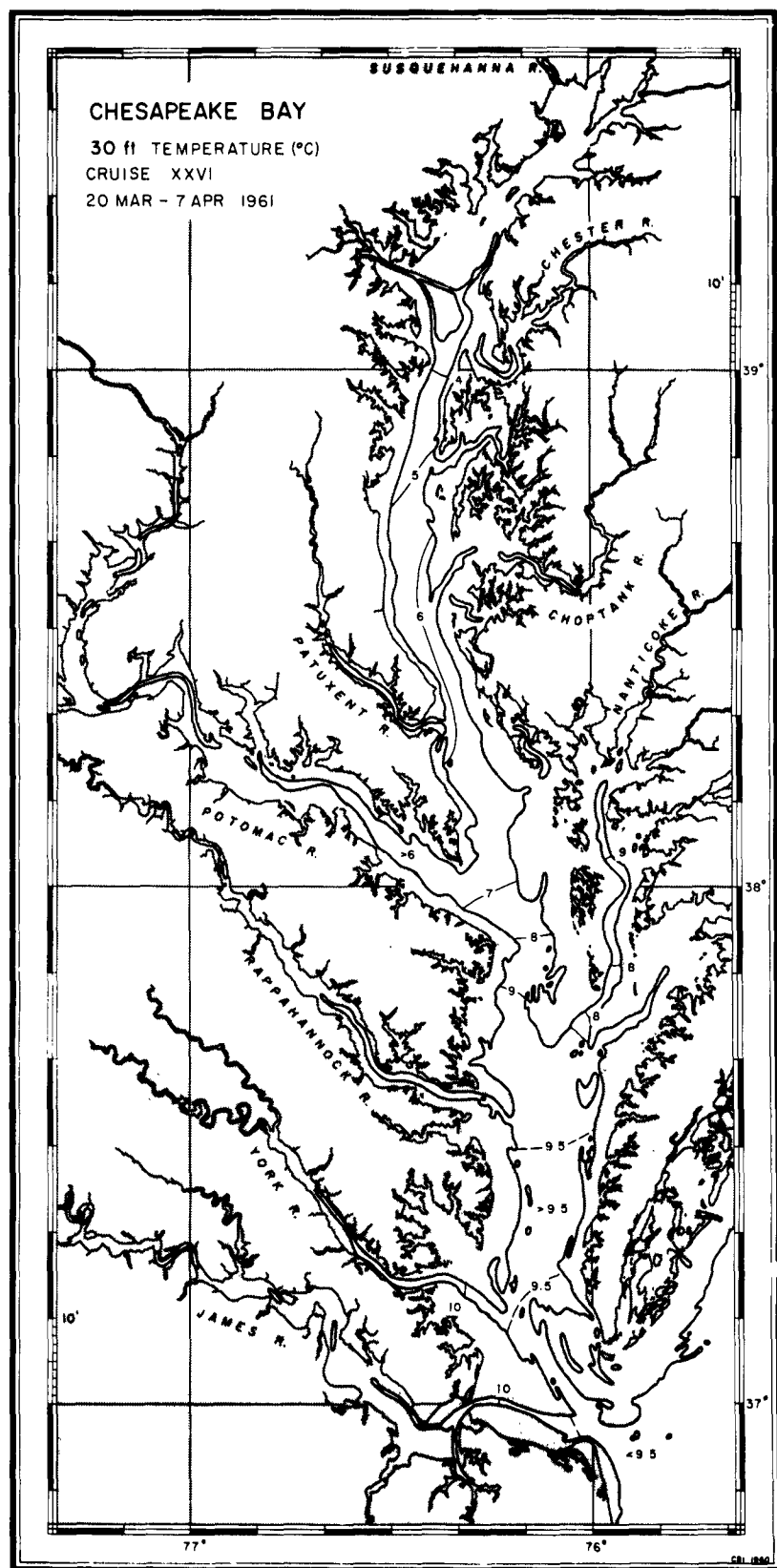


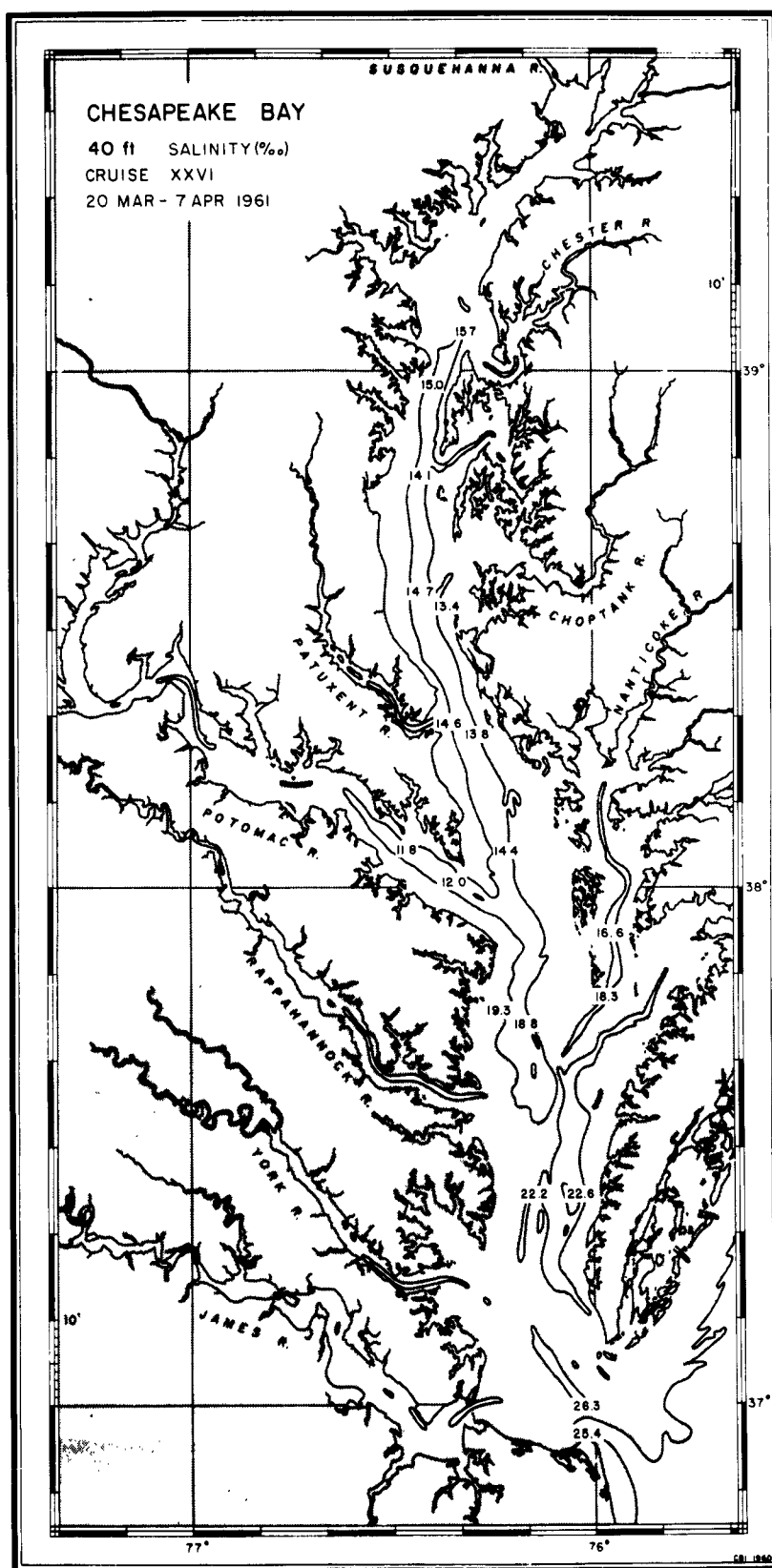


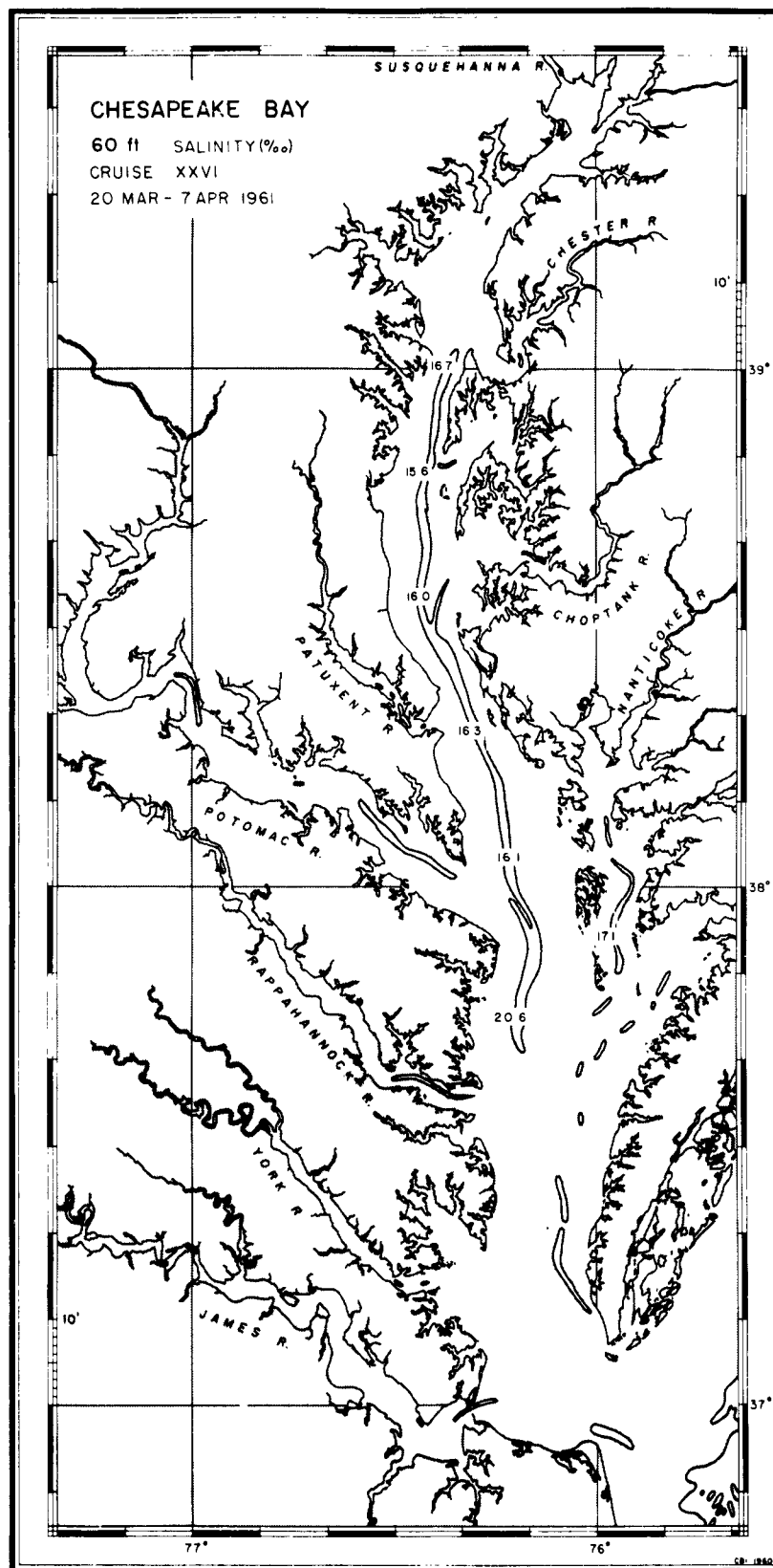


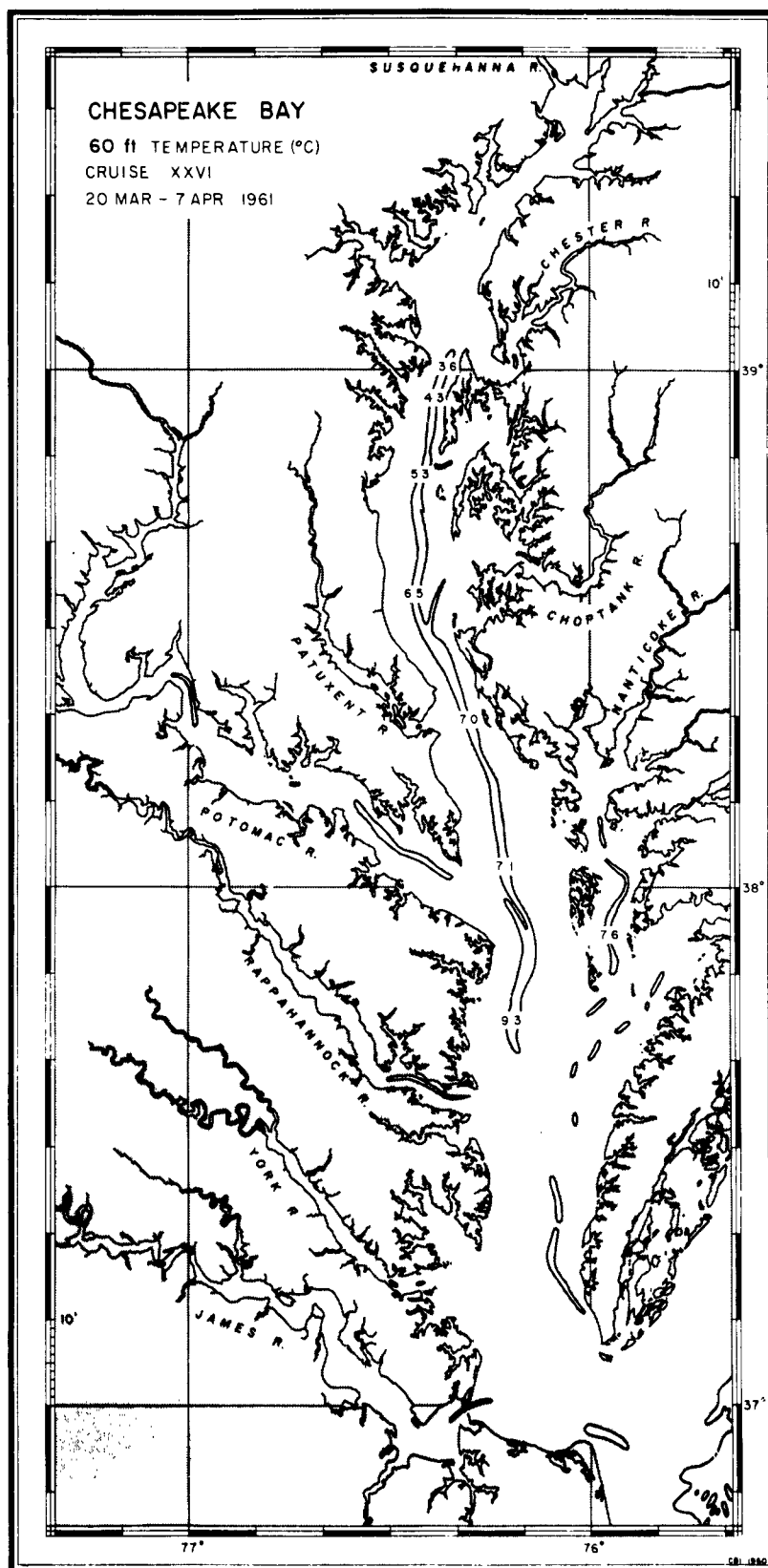




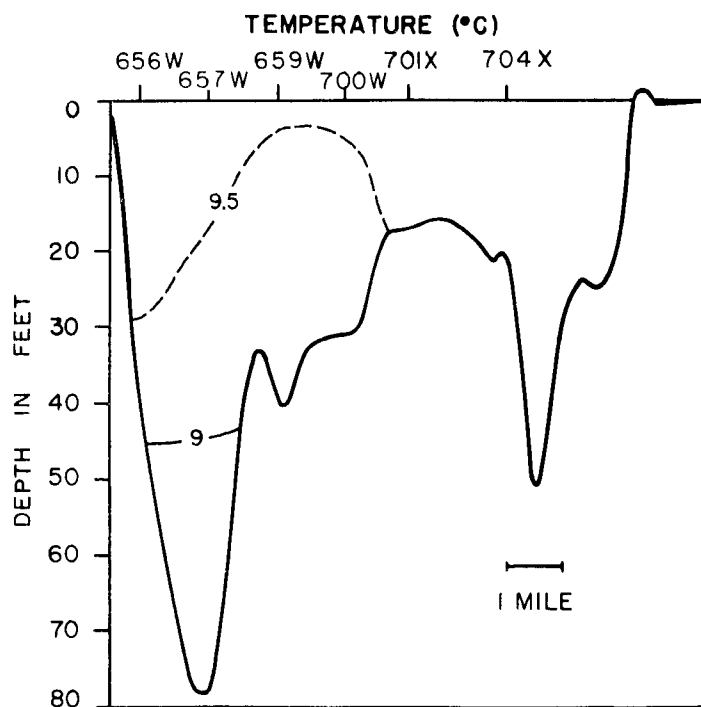
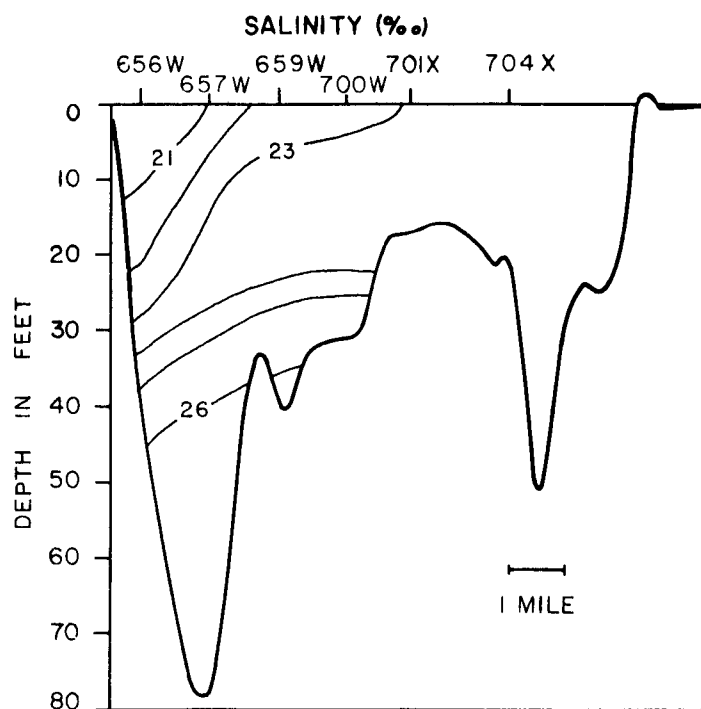




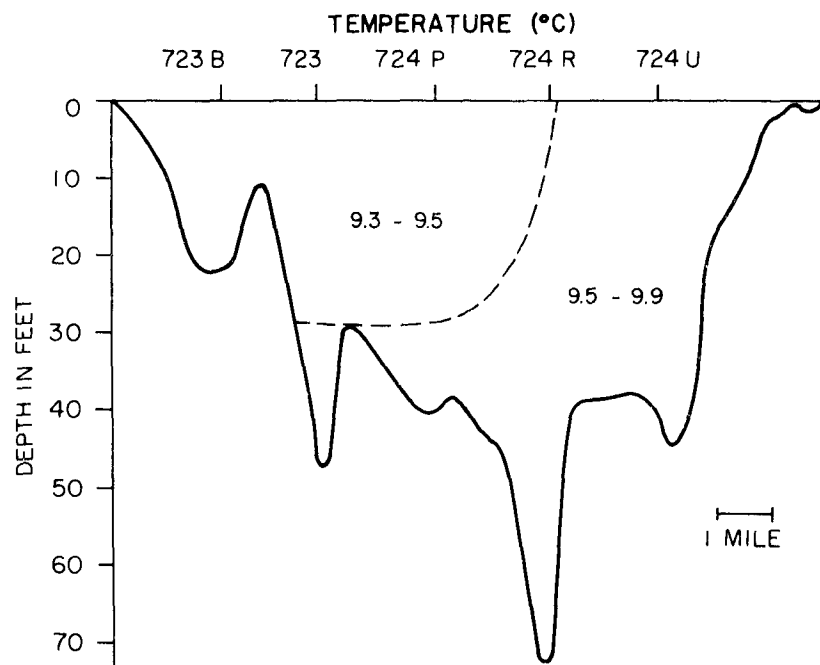
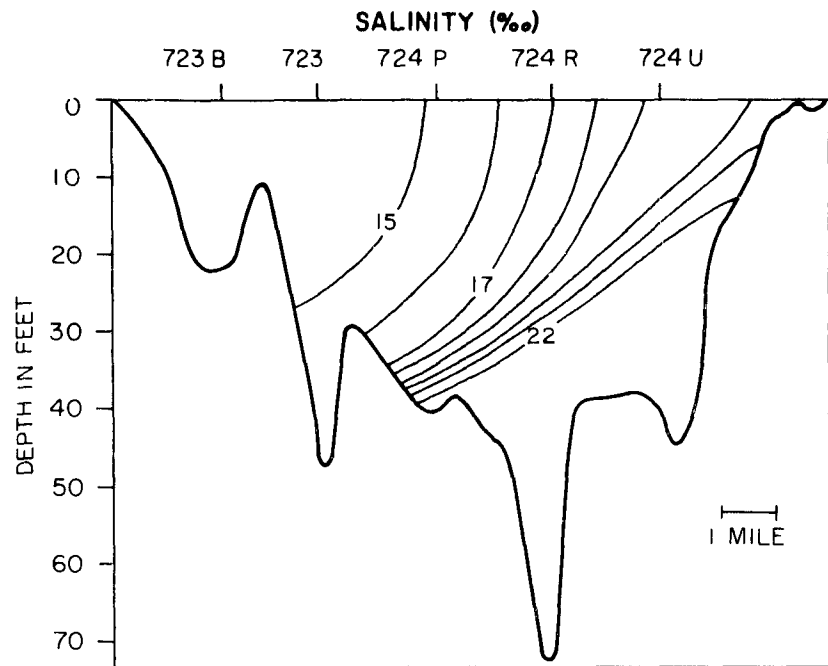




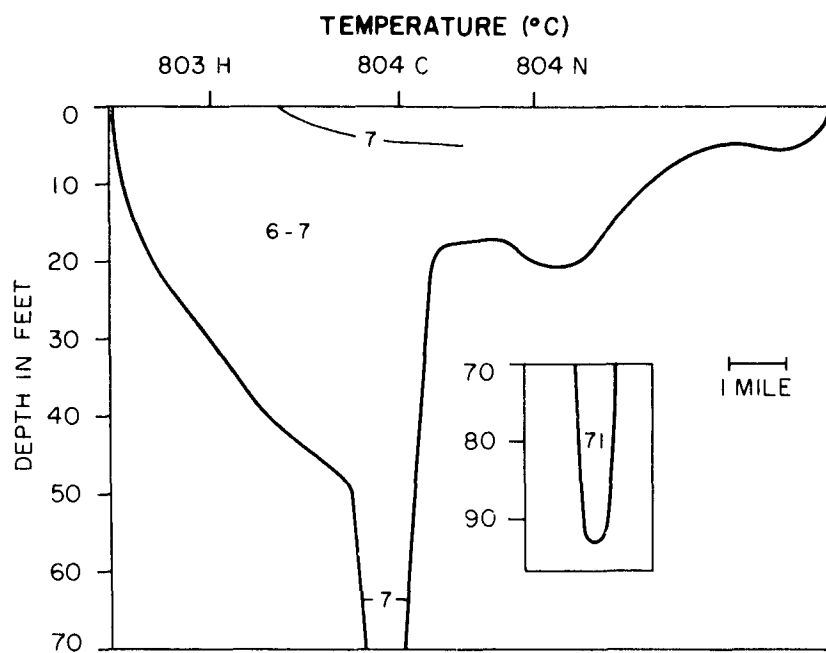
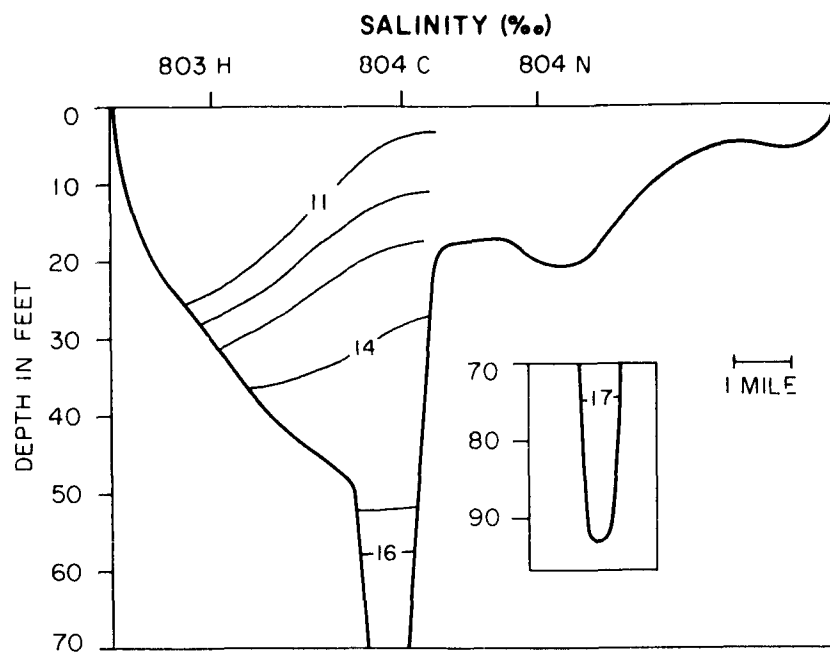
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION II



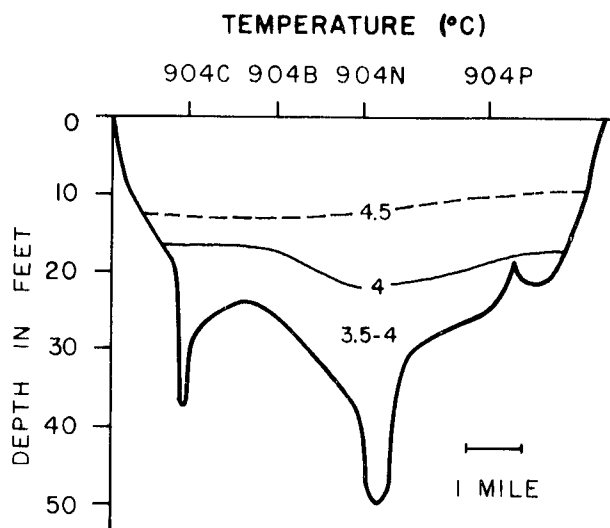
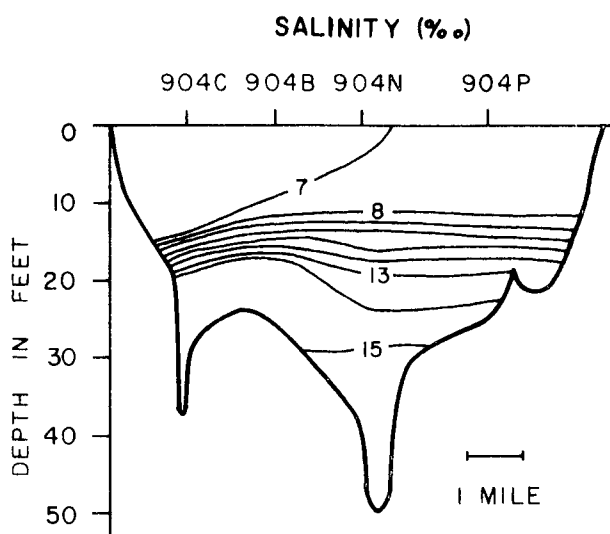
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION IV



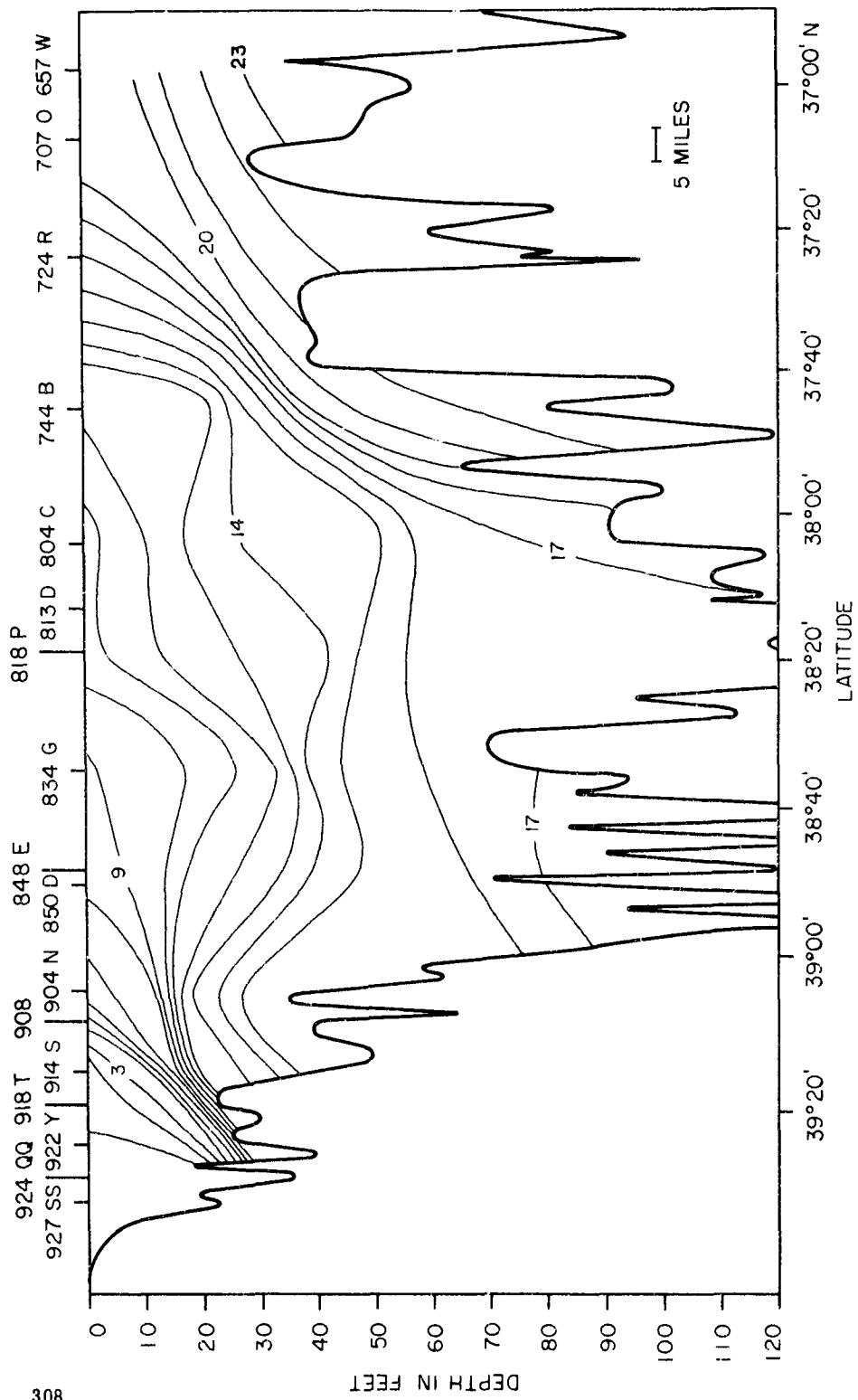
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION VI



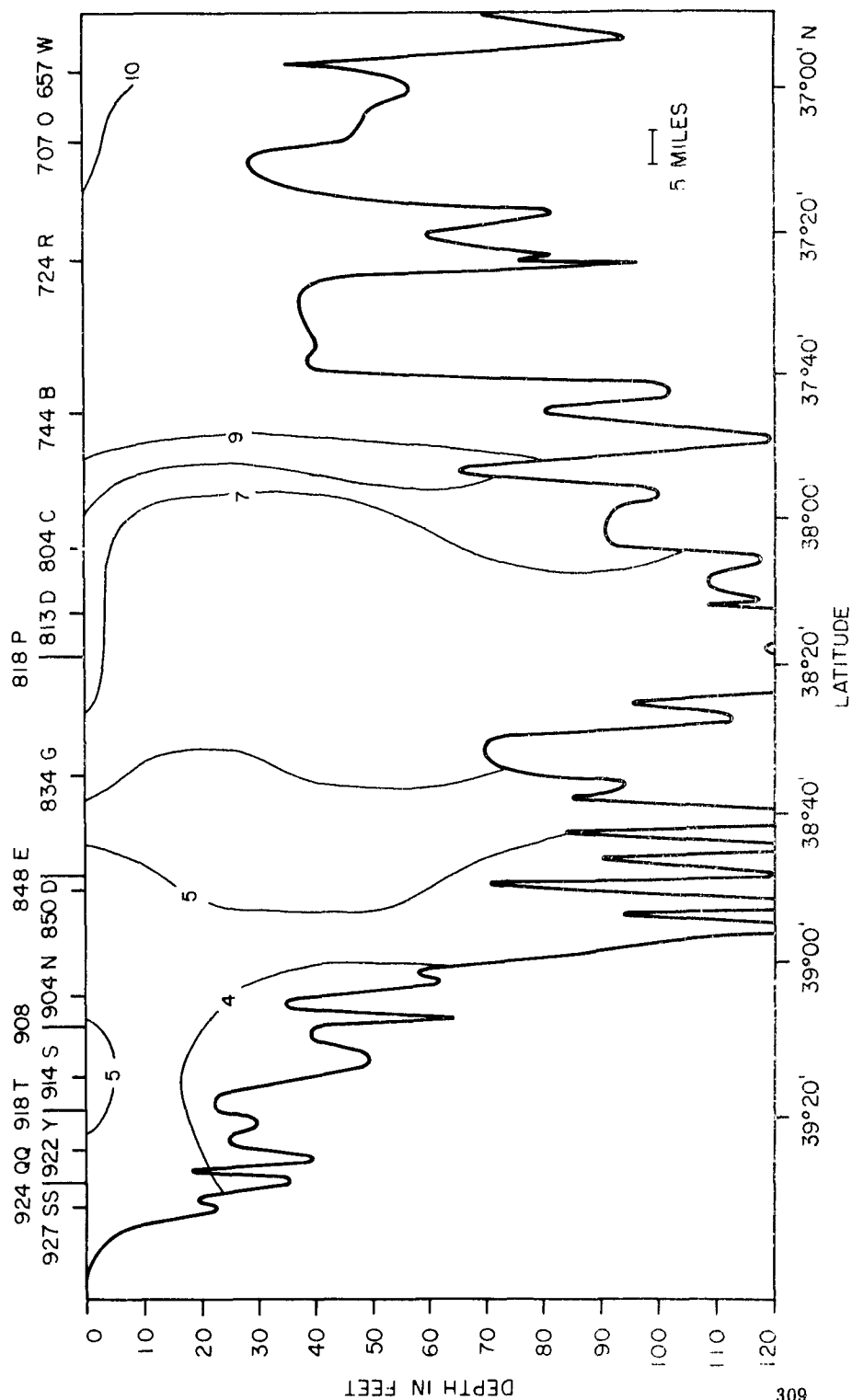
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION X

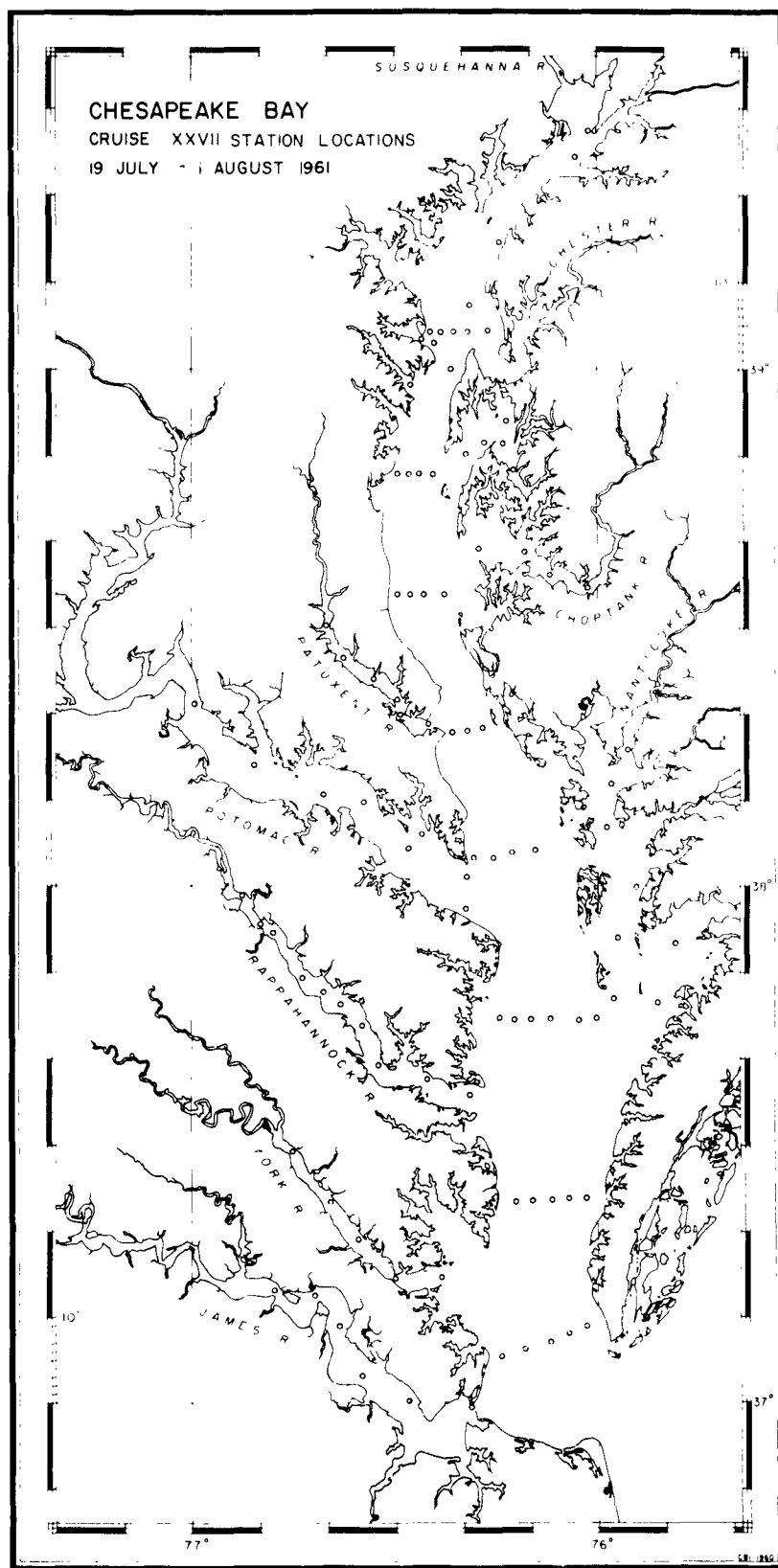


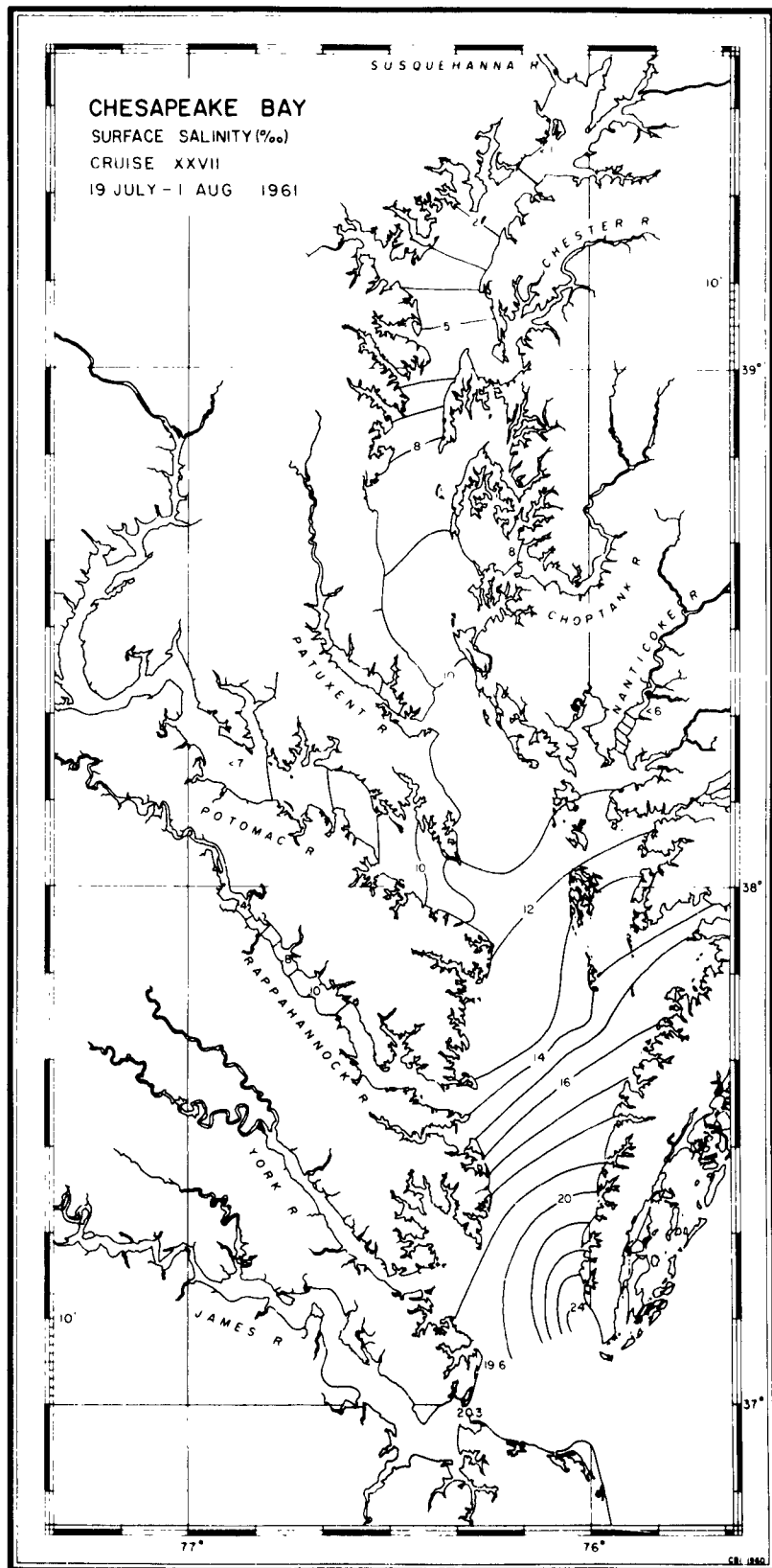
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION XIX
SALINITY (‰)

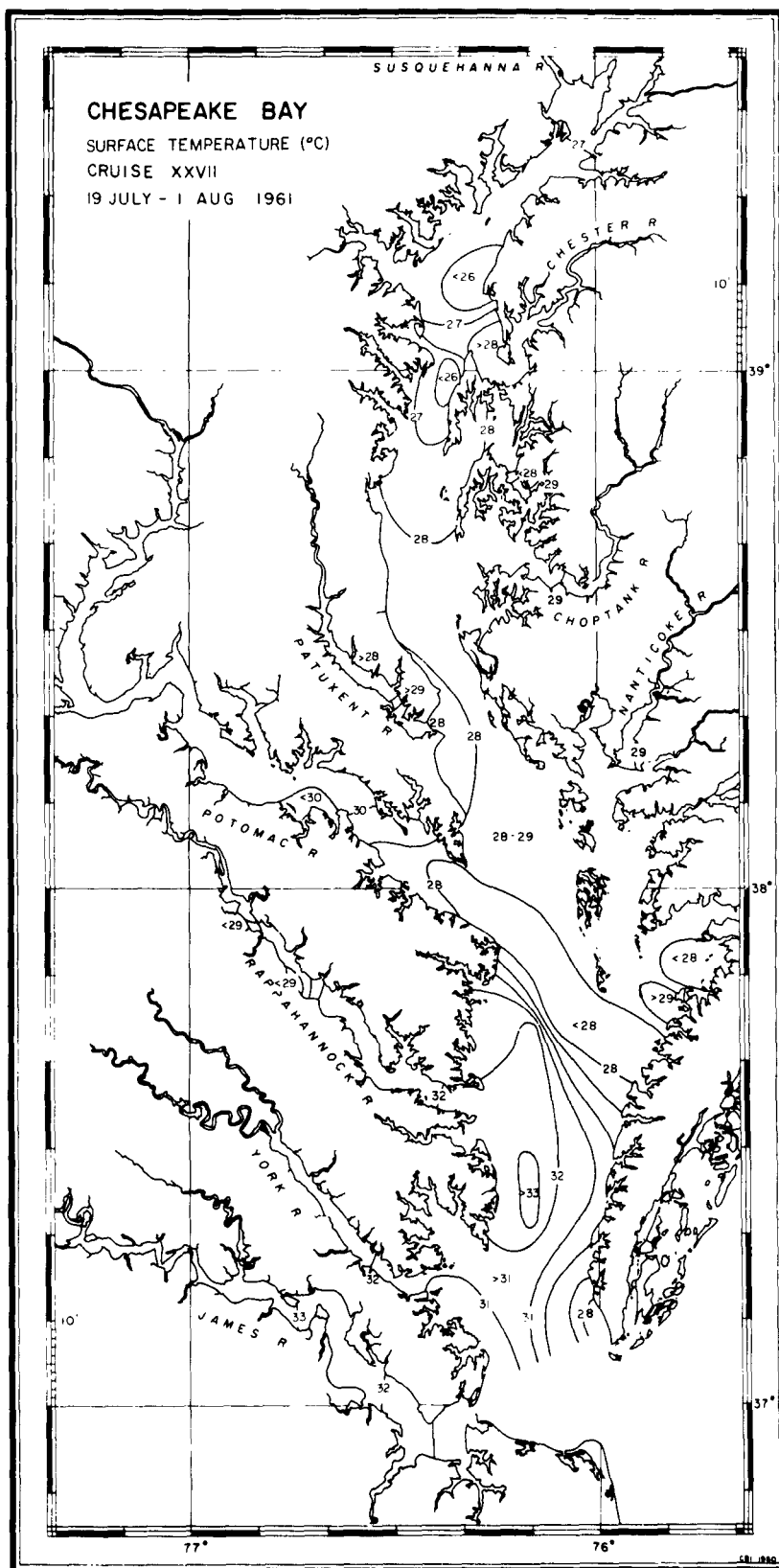


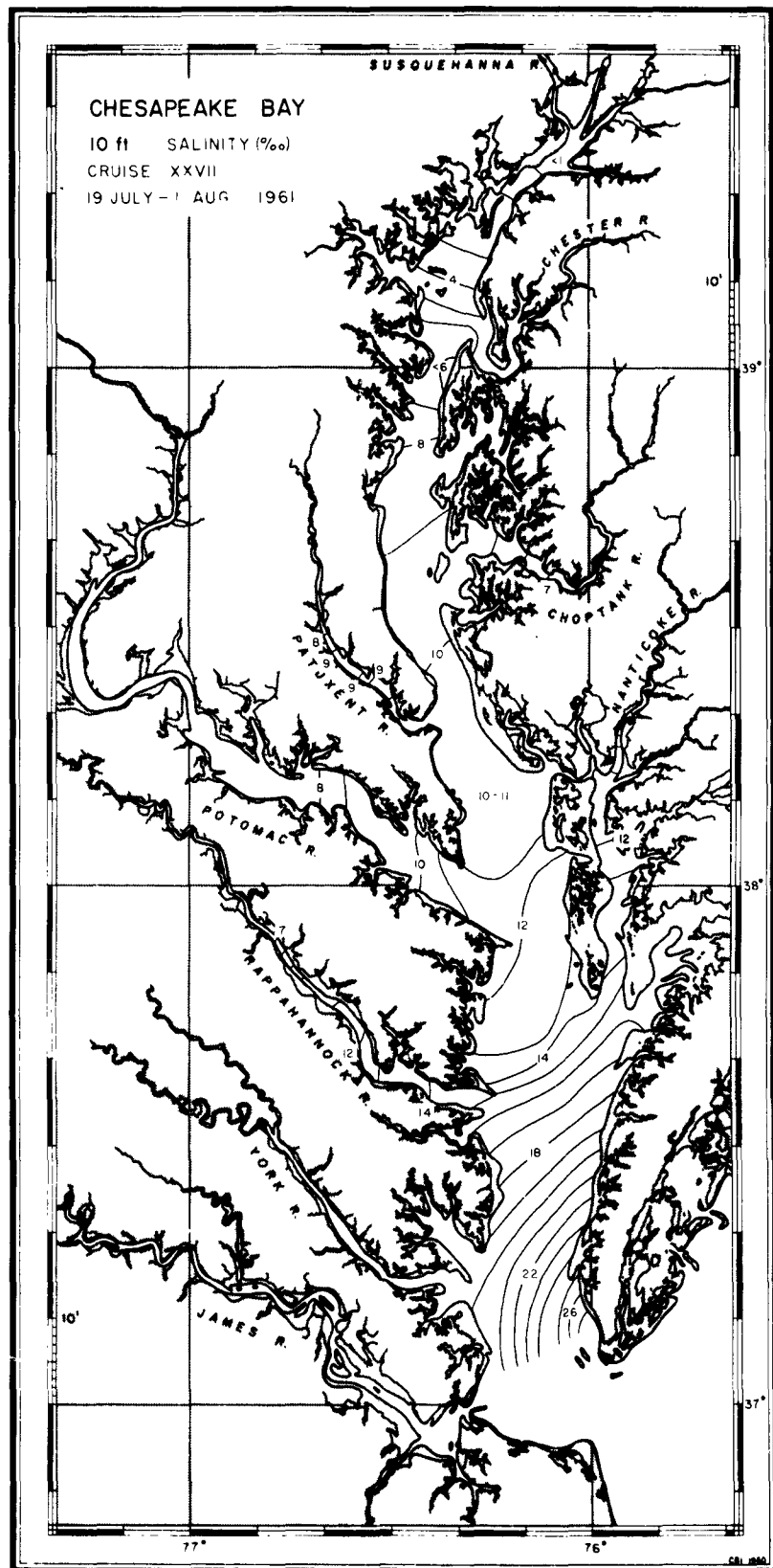
CRUISE XXVI 20 MAR - 7 APRIL 1961 SECTION XIX
TEMPERATURE (°C)

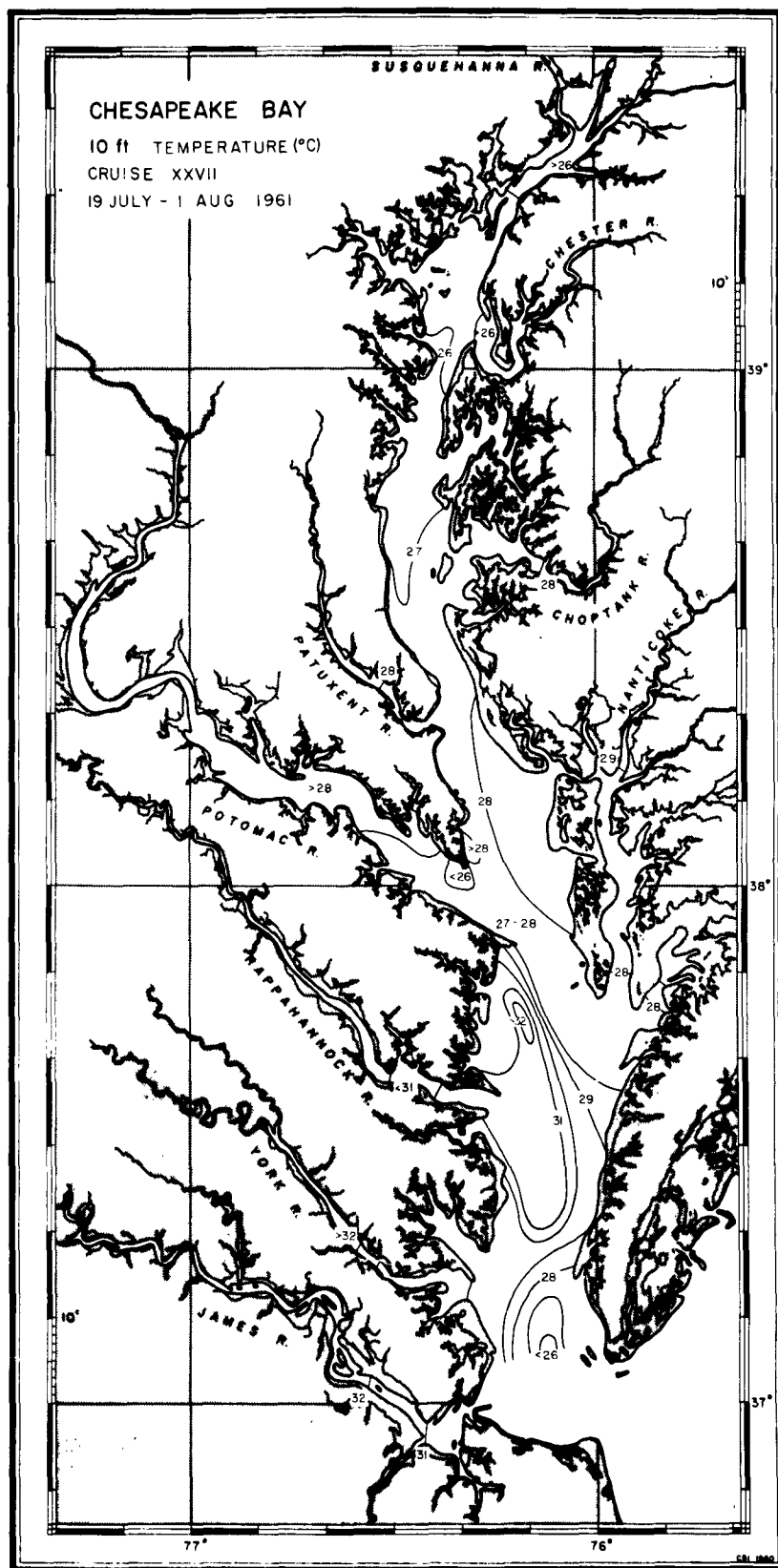


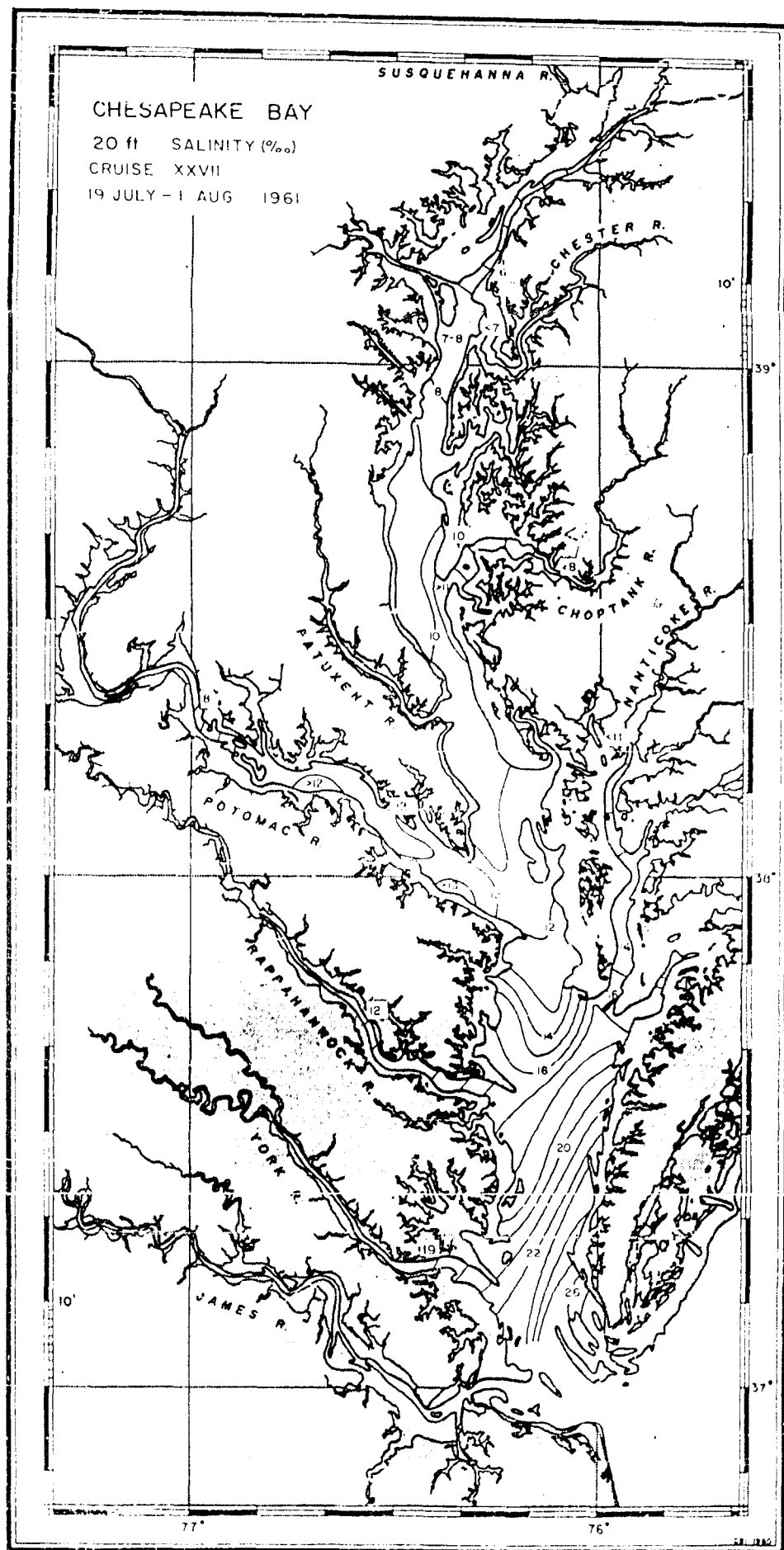


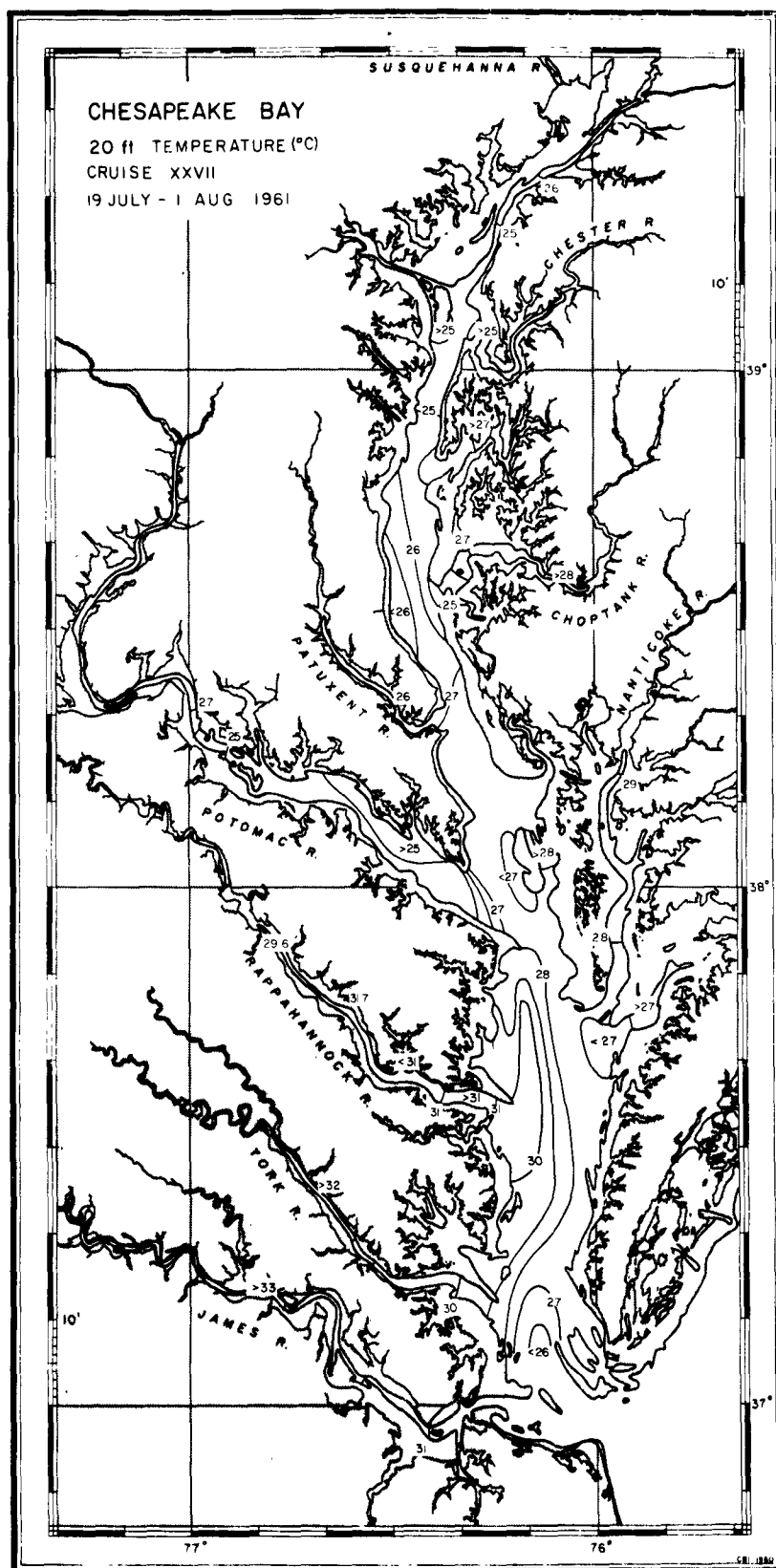


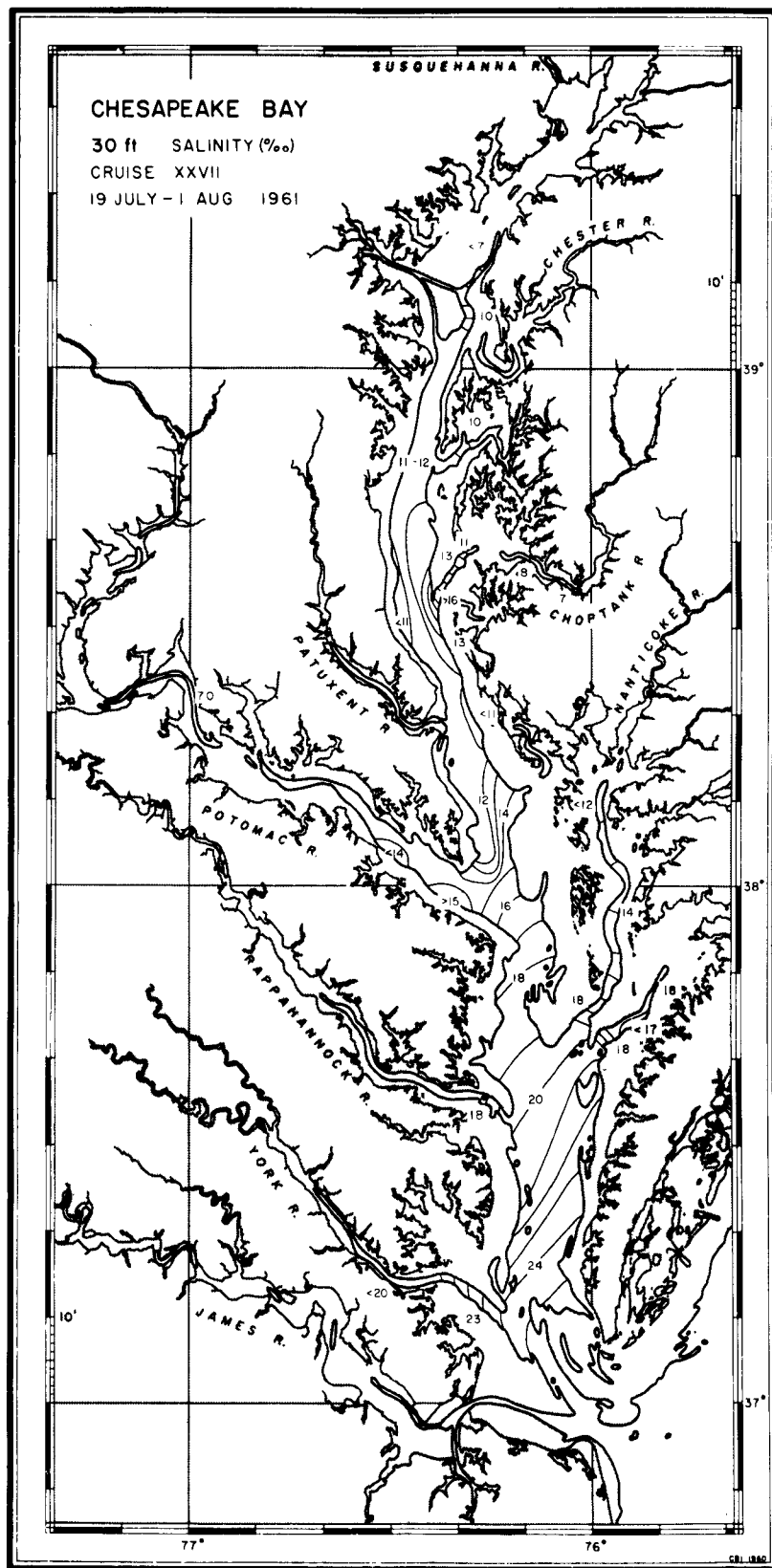


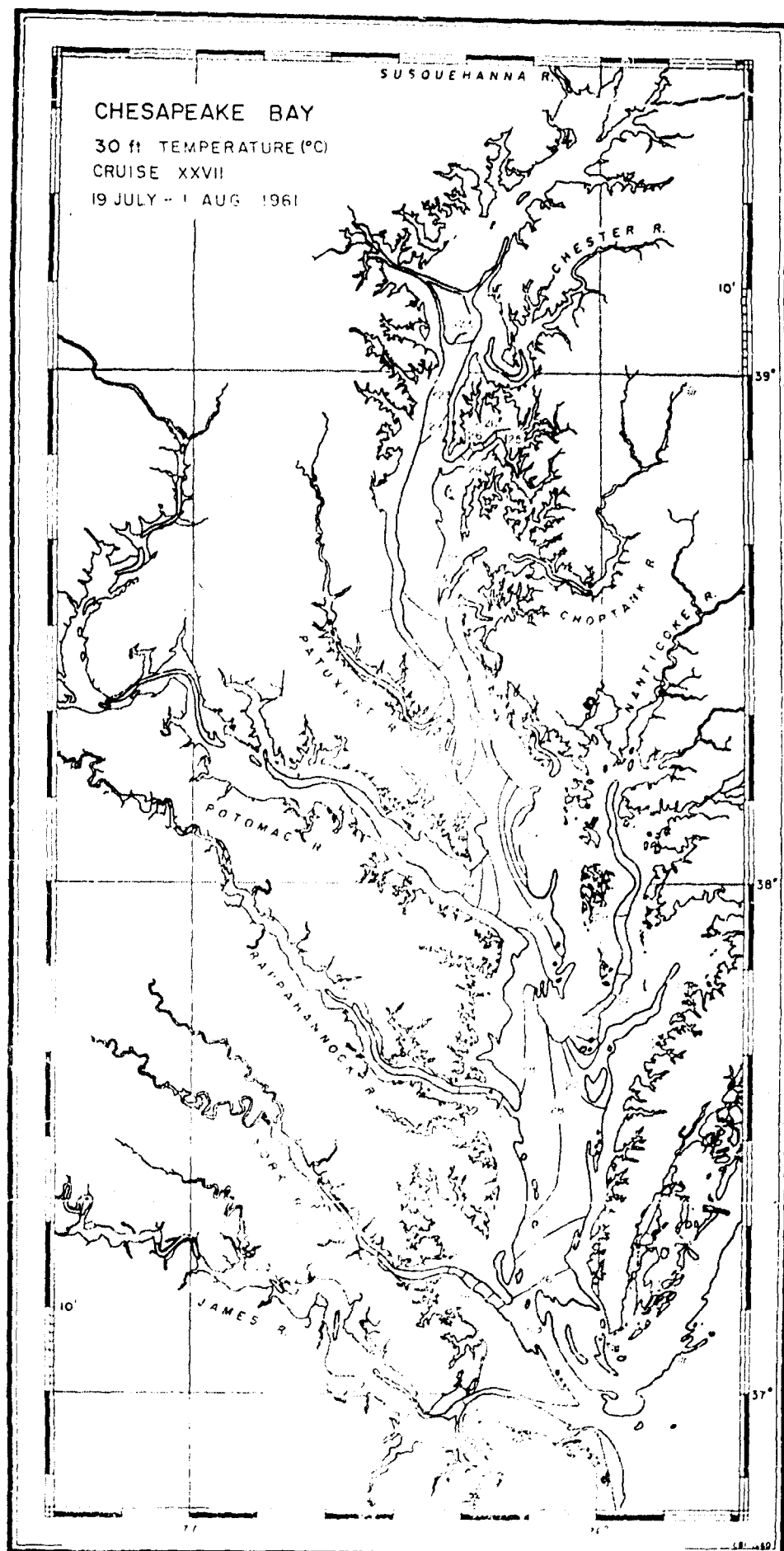


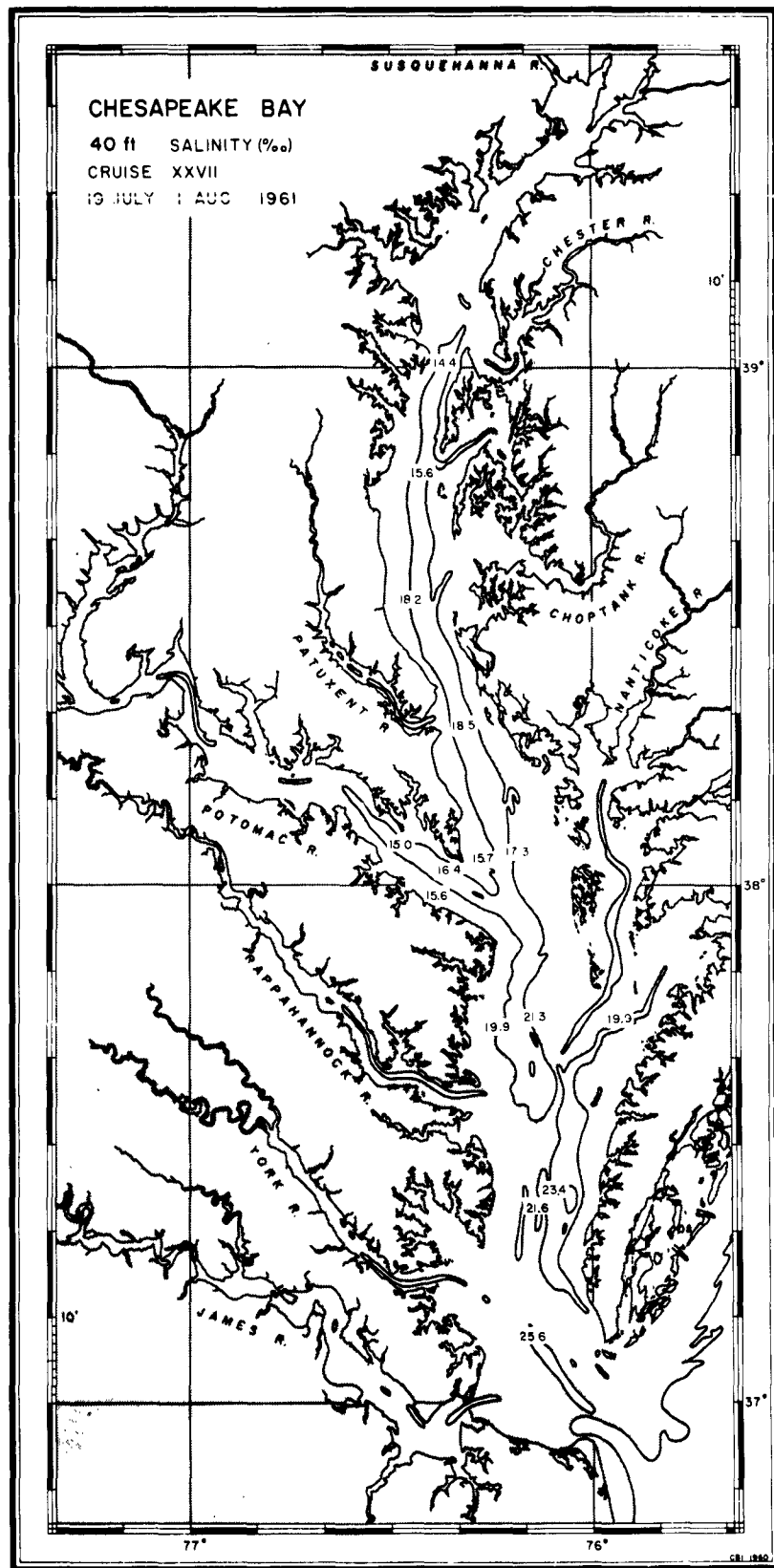


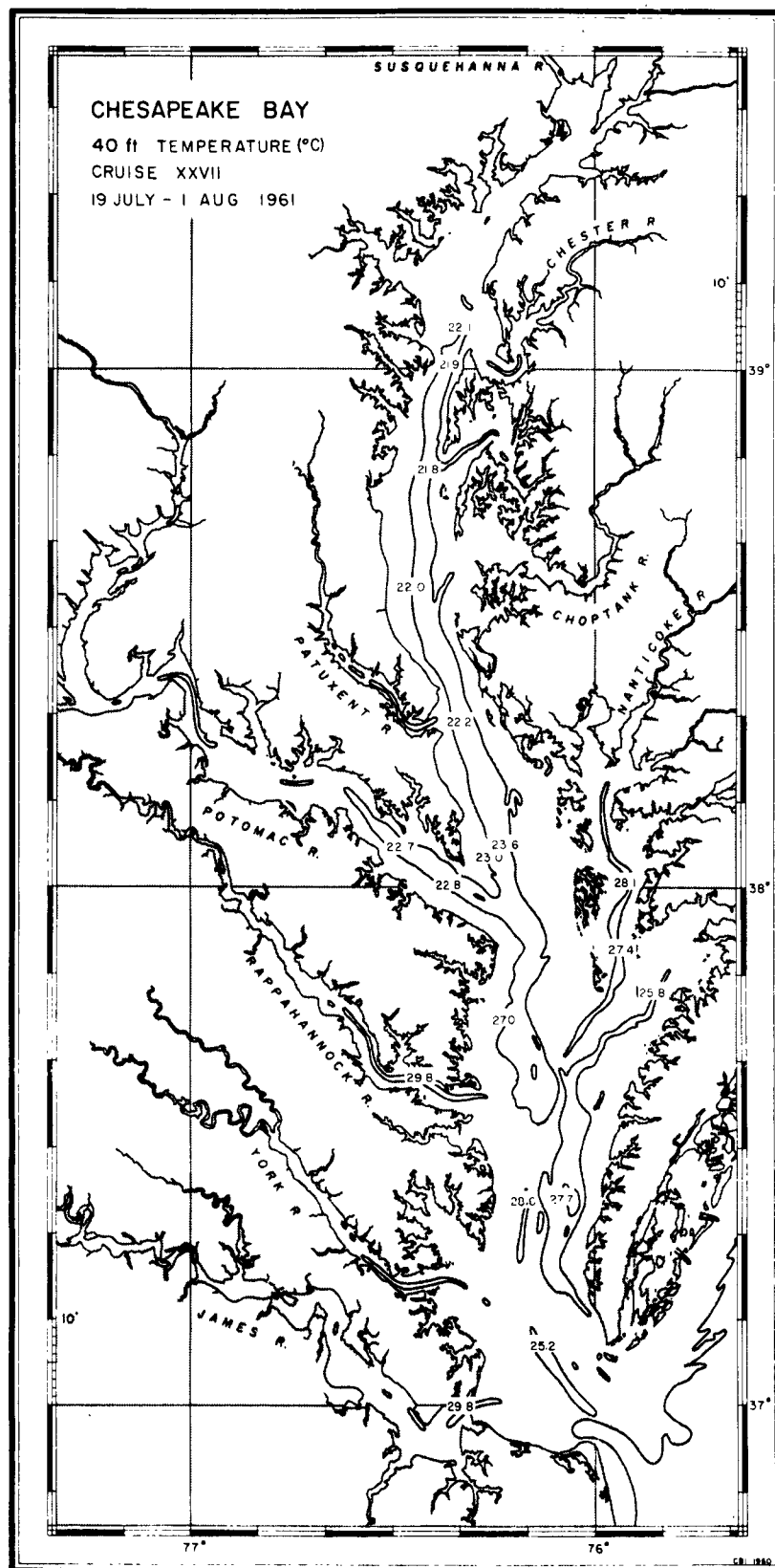


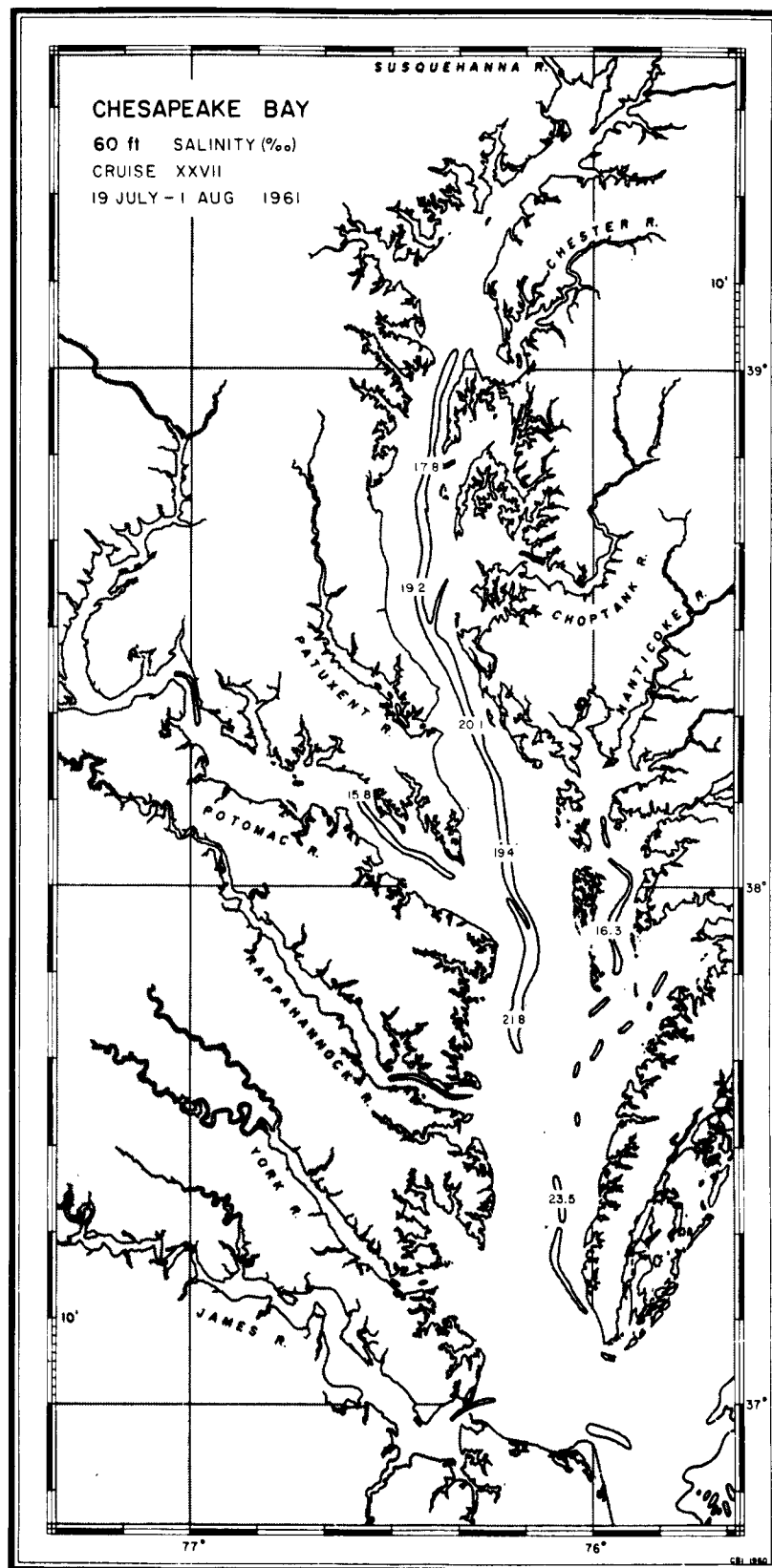


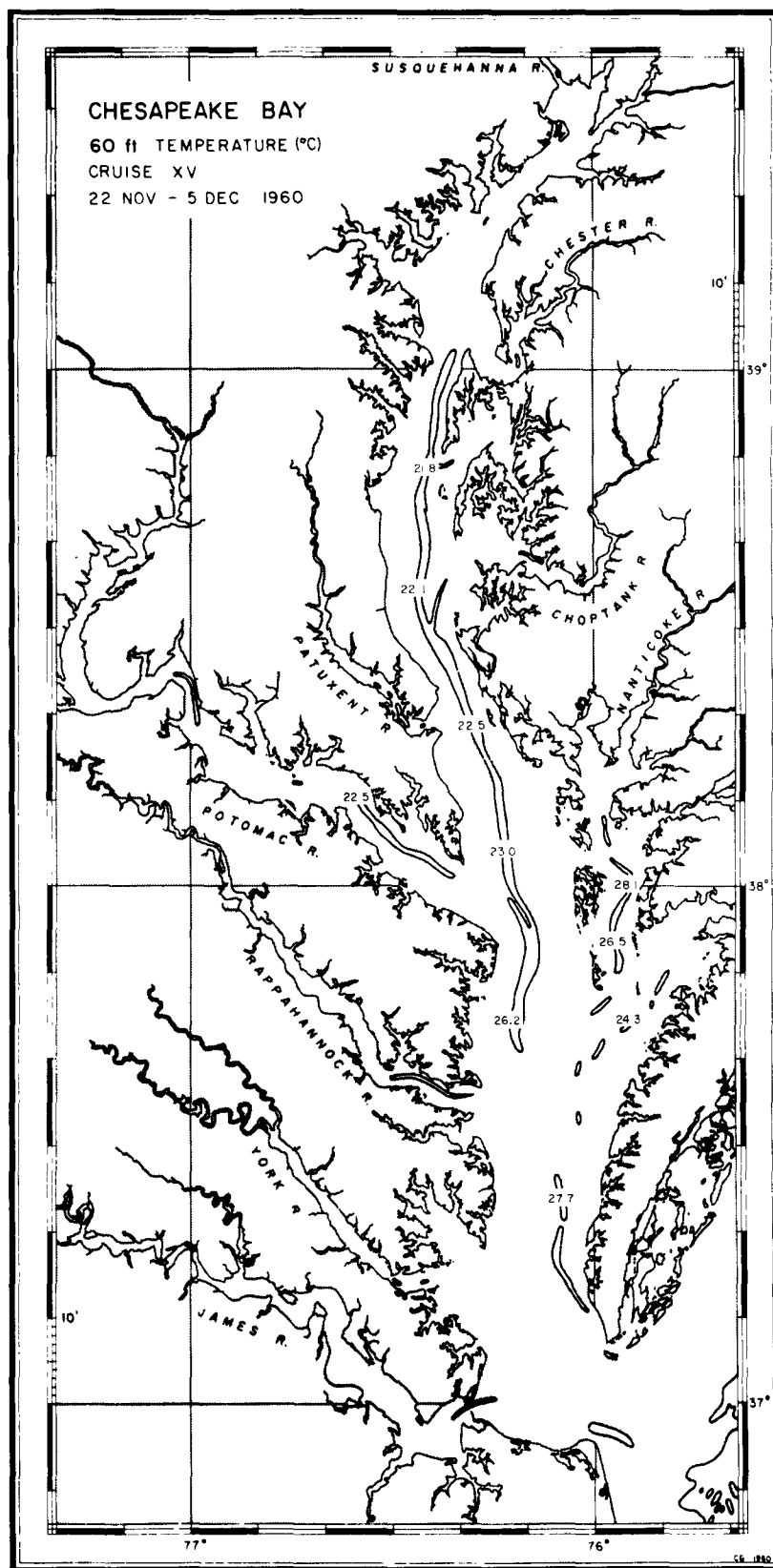






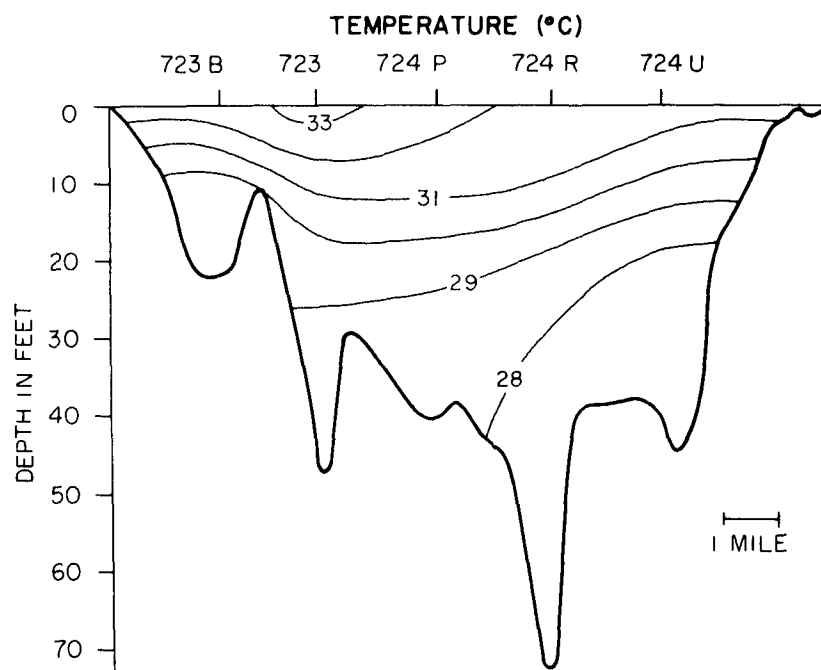
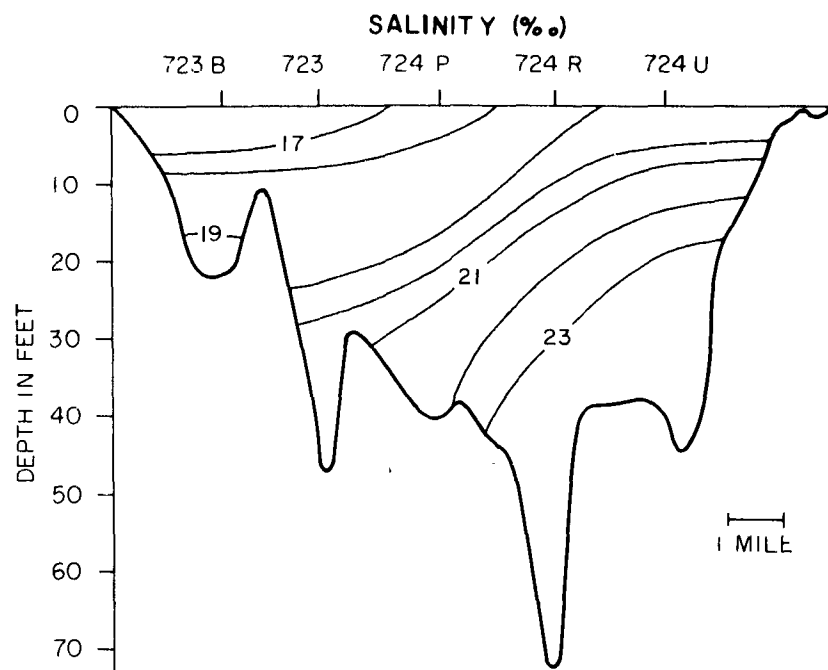




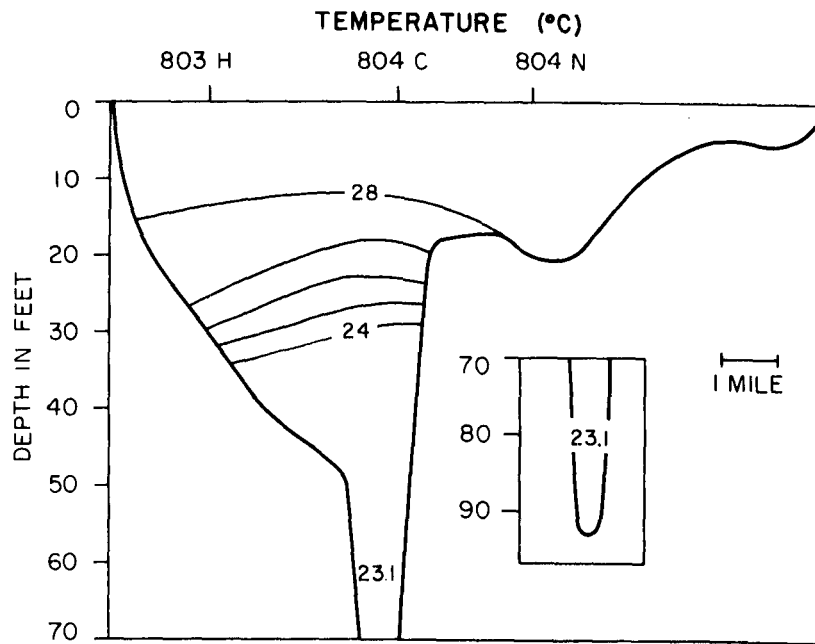
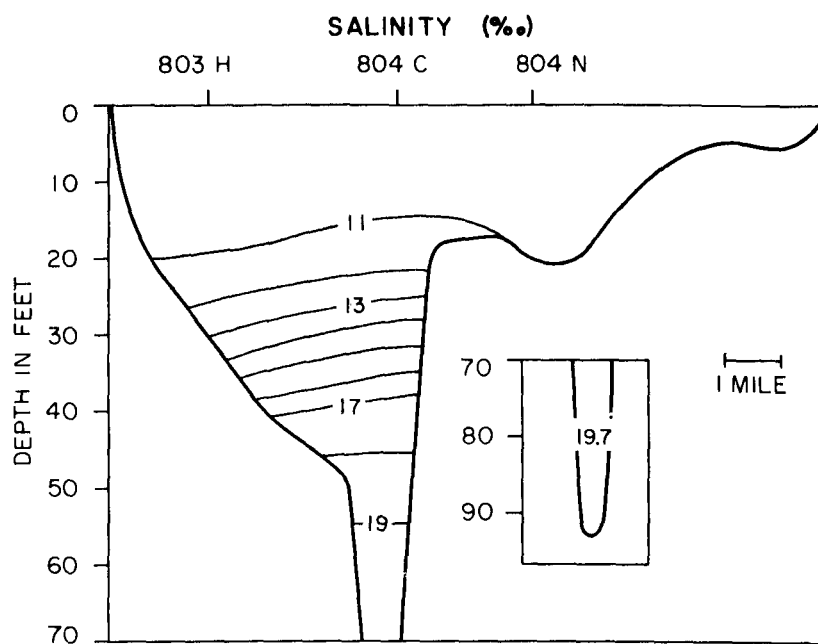


SECTION OMITTED
INSUFFICIENT DATA

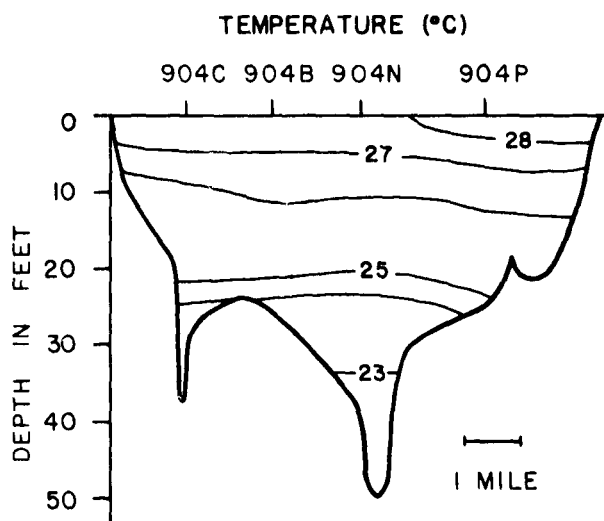
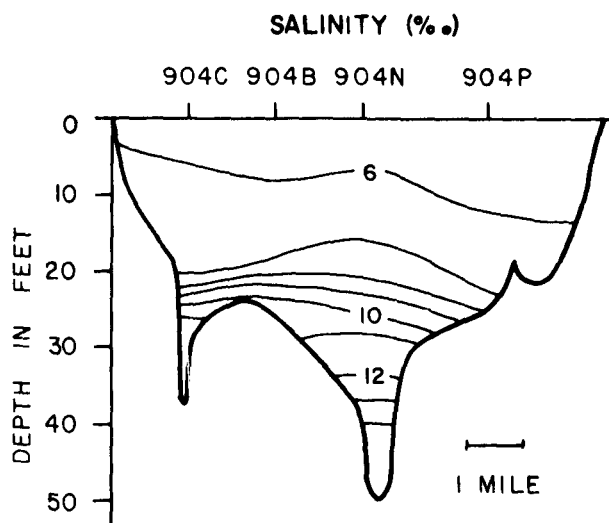
CRUISE XXVII 19 JULY - 1 AUG 1961 SECTION IV



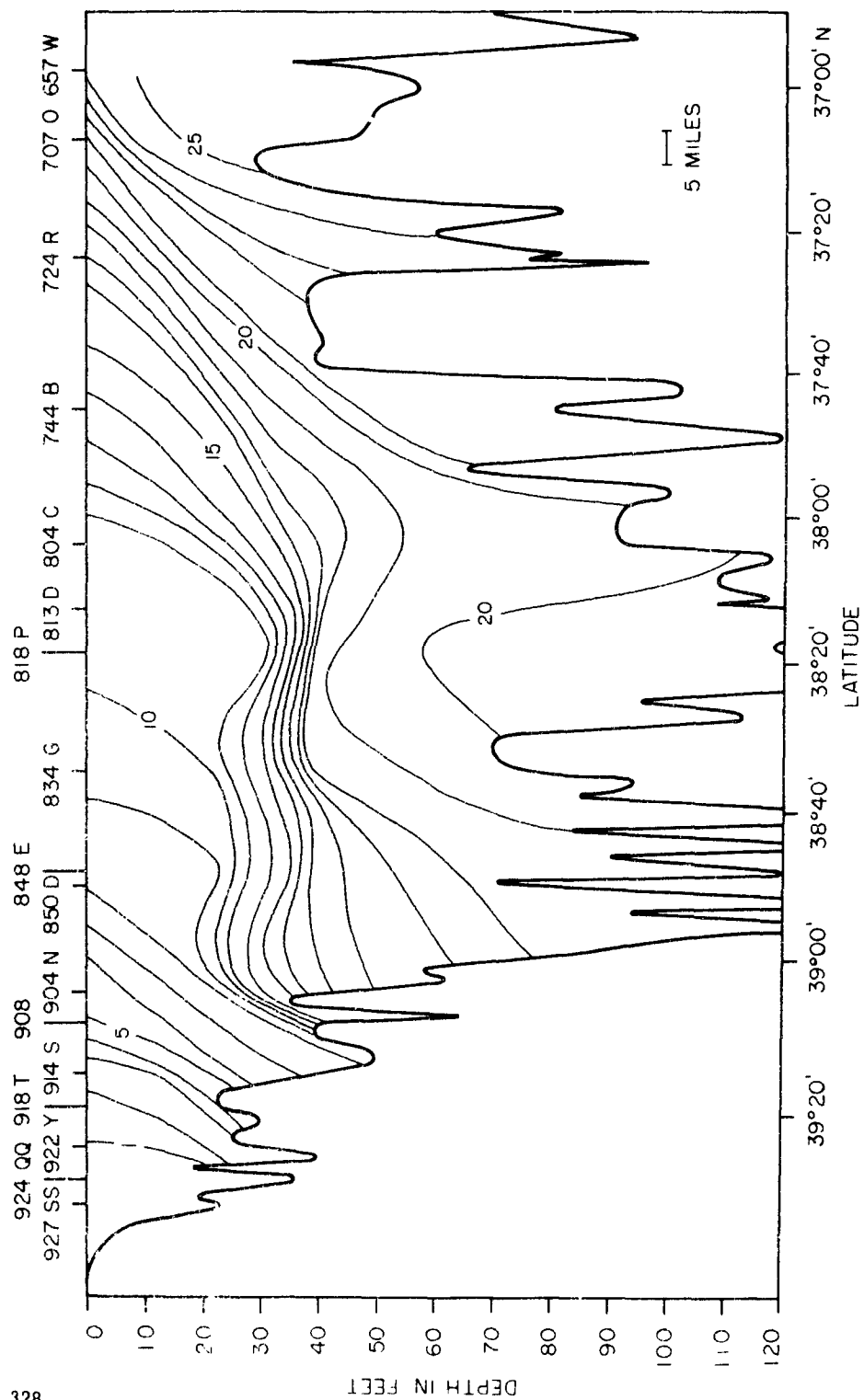
CRUISE XXVII 19 JULY - 1 AUG 1961 SECTION VI



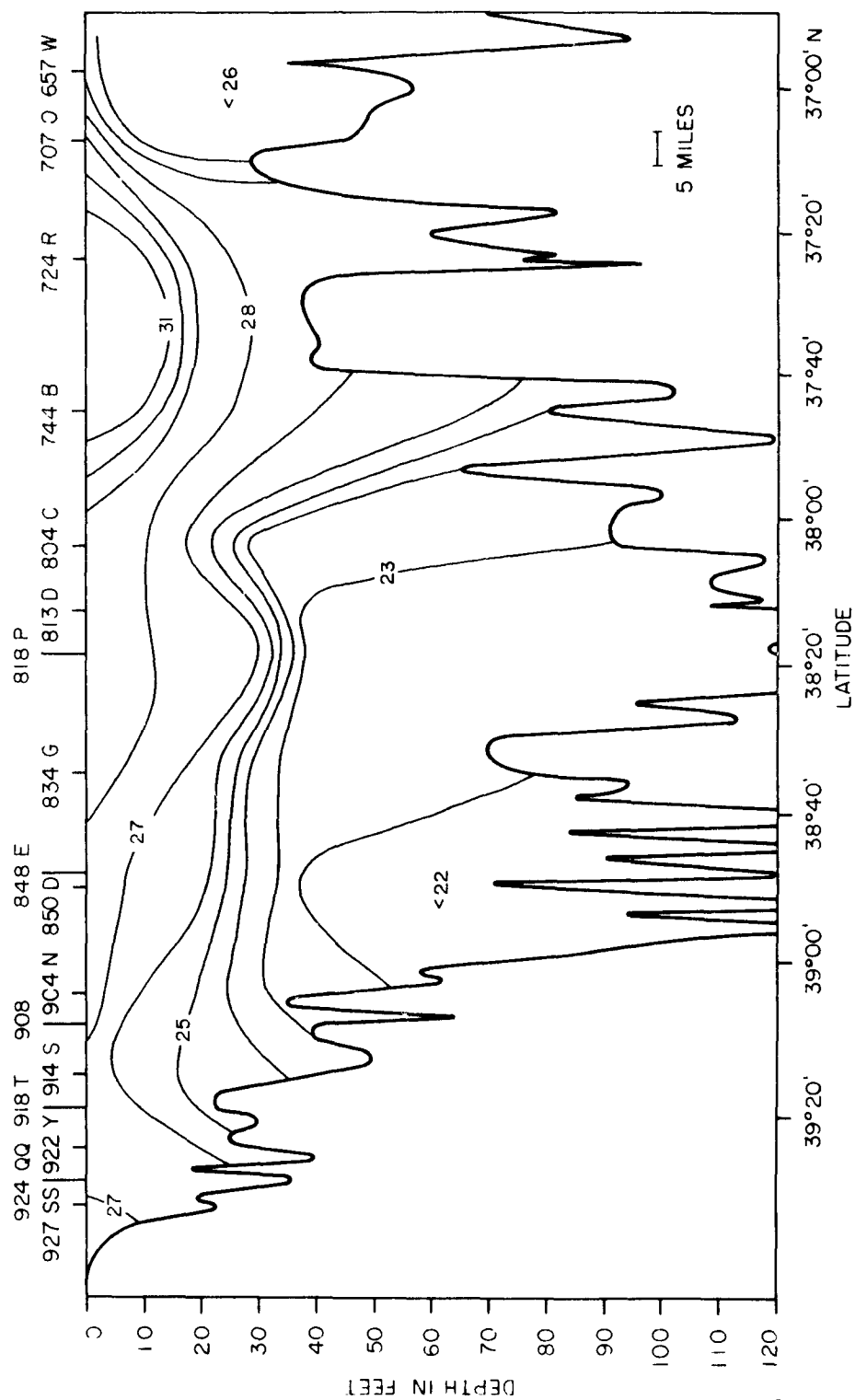
CRUISE XXVII 19 JULY - 1 AUG 1961 SECTION X



CRUISE XXVII 19 JULY - 1 AUG 1961 SECTION XIX
SALINITY (‰)

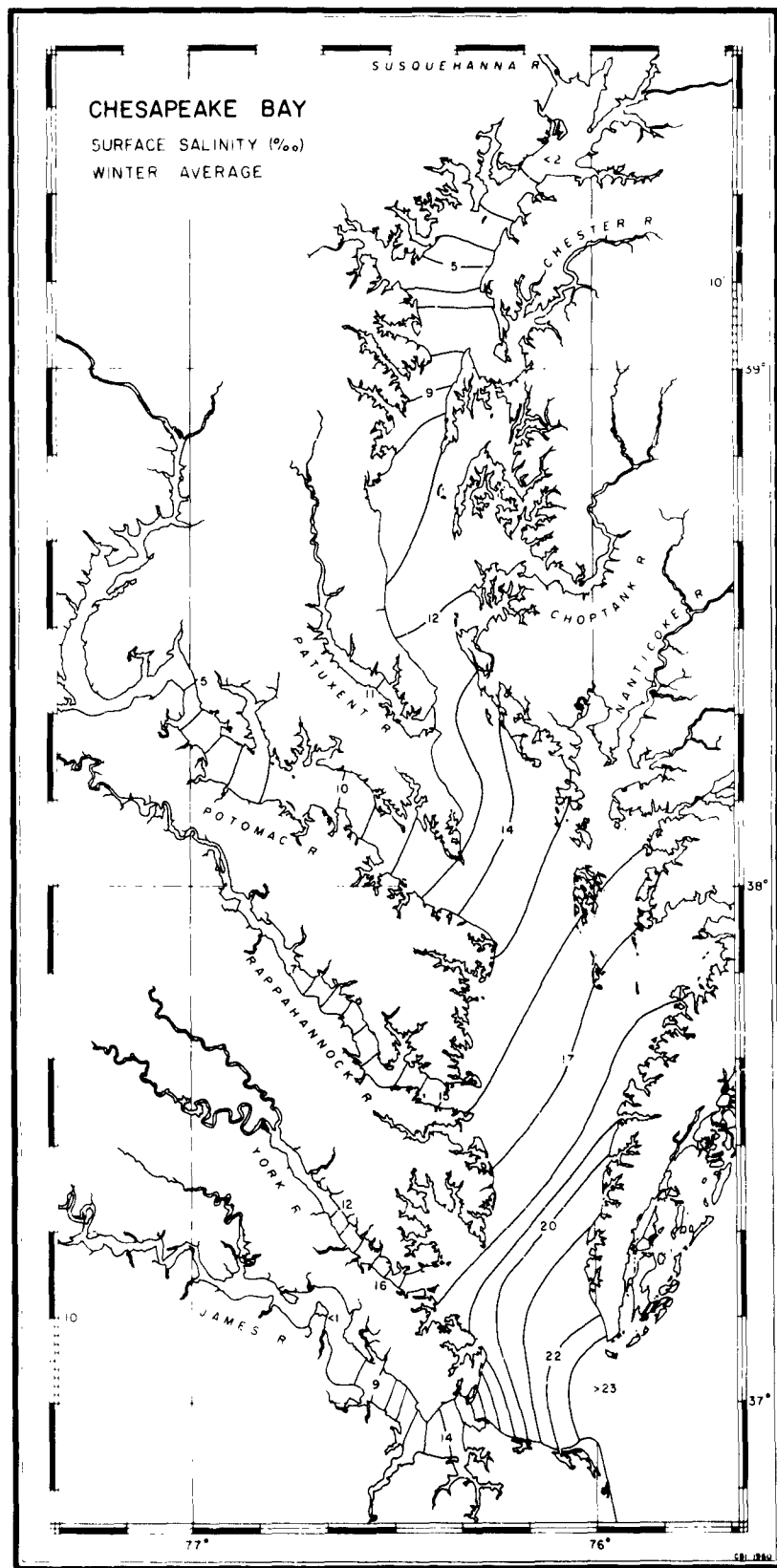


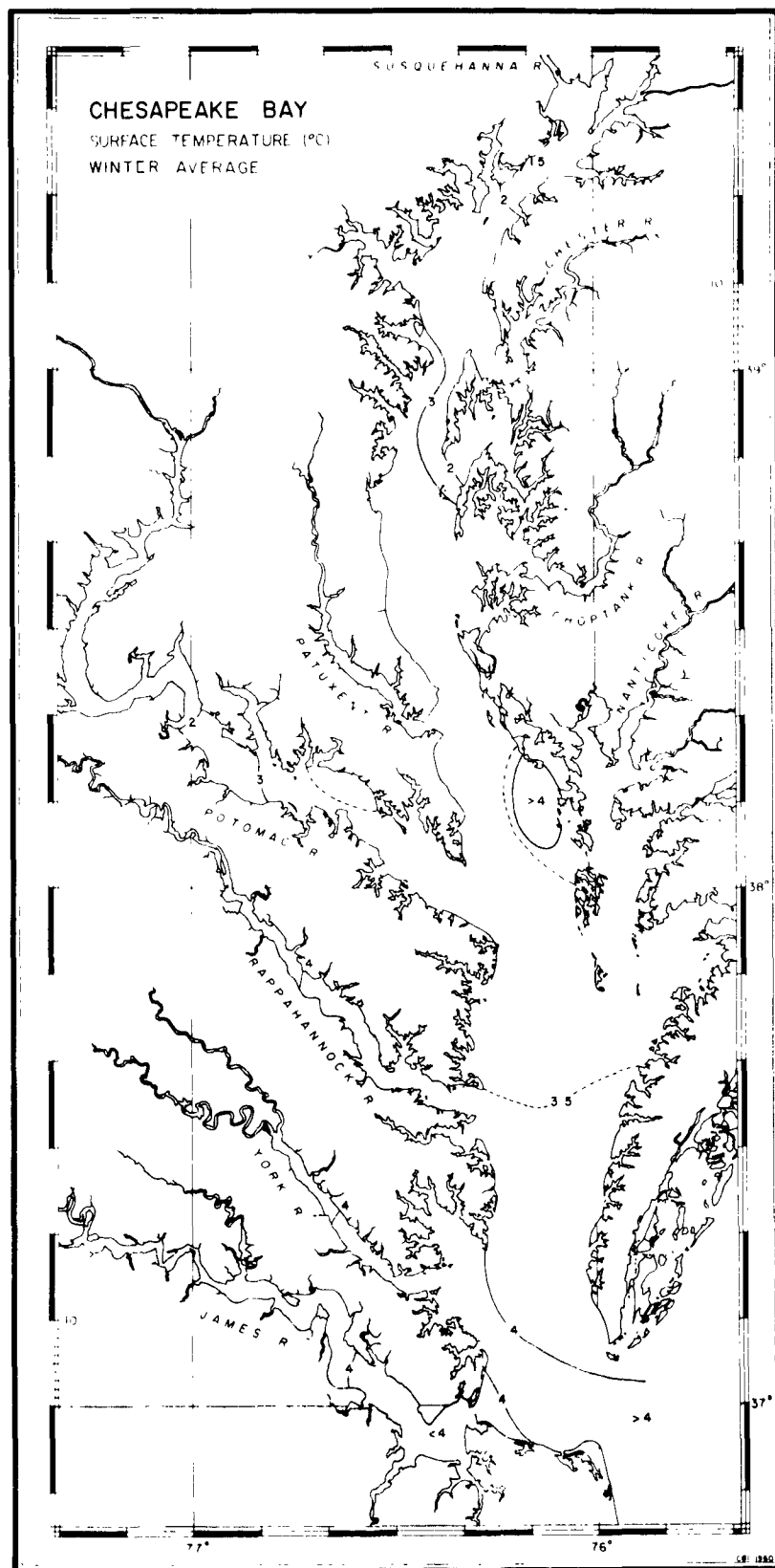
CRUISE XXVII 19 JULY - 1 AUG 1961 SECTION II
TEMPERATURE (°C)

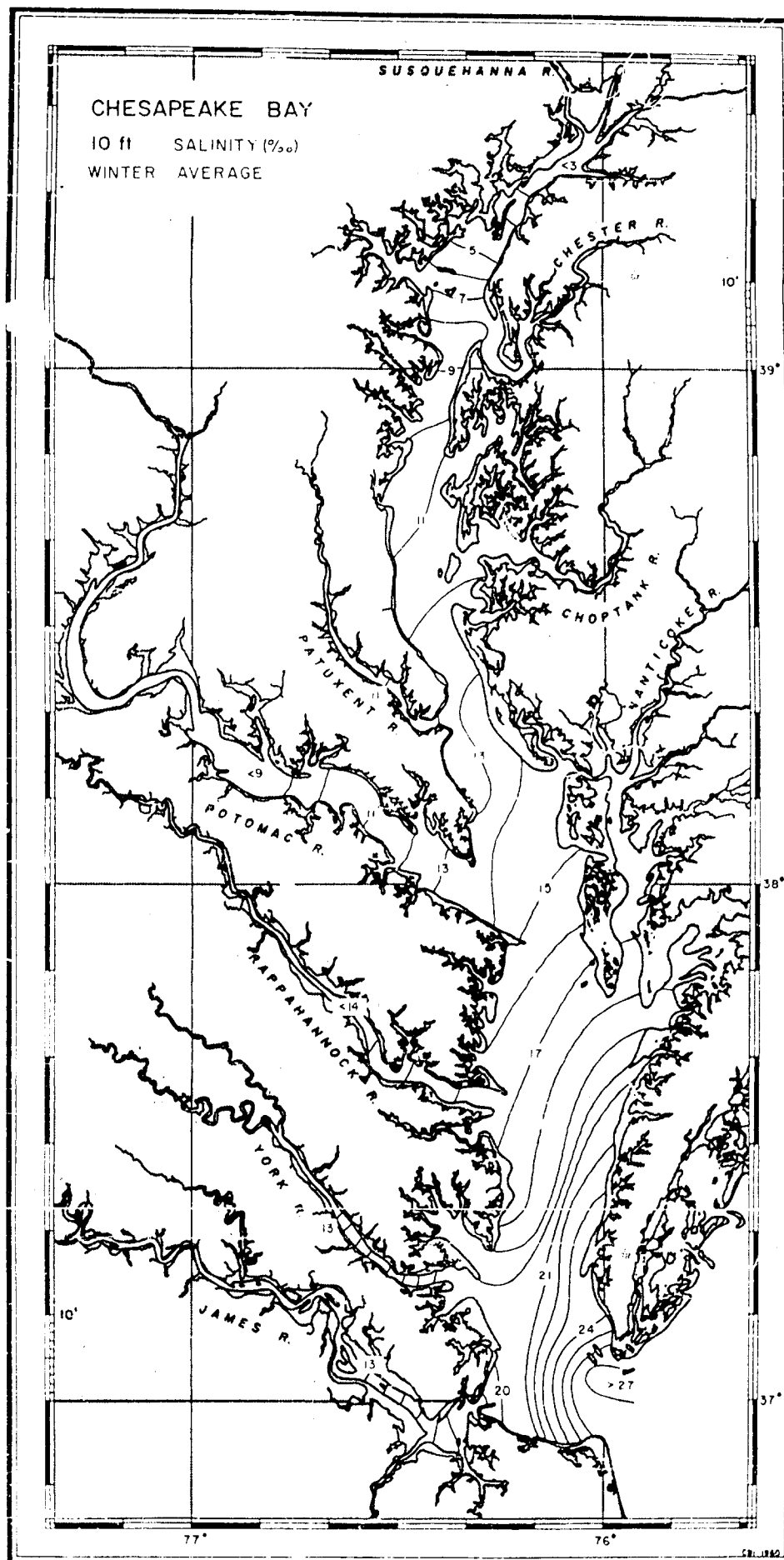


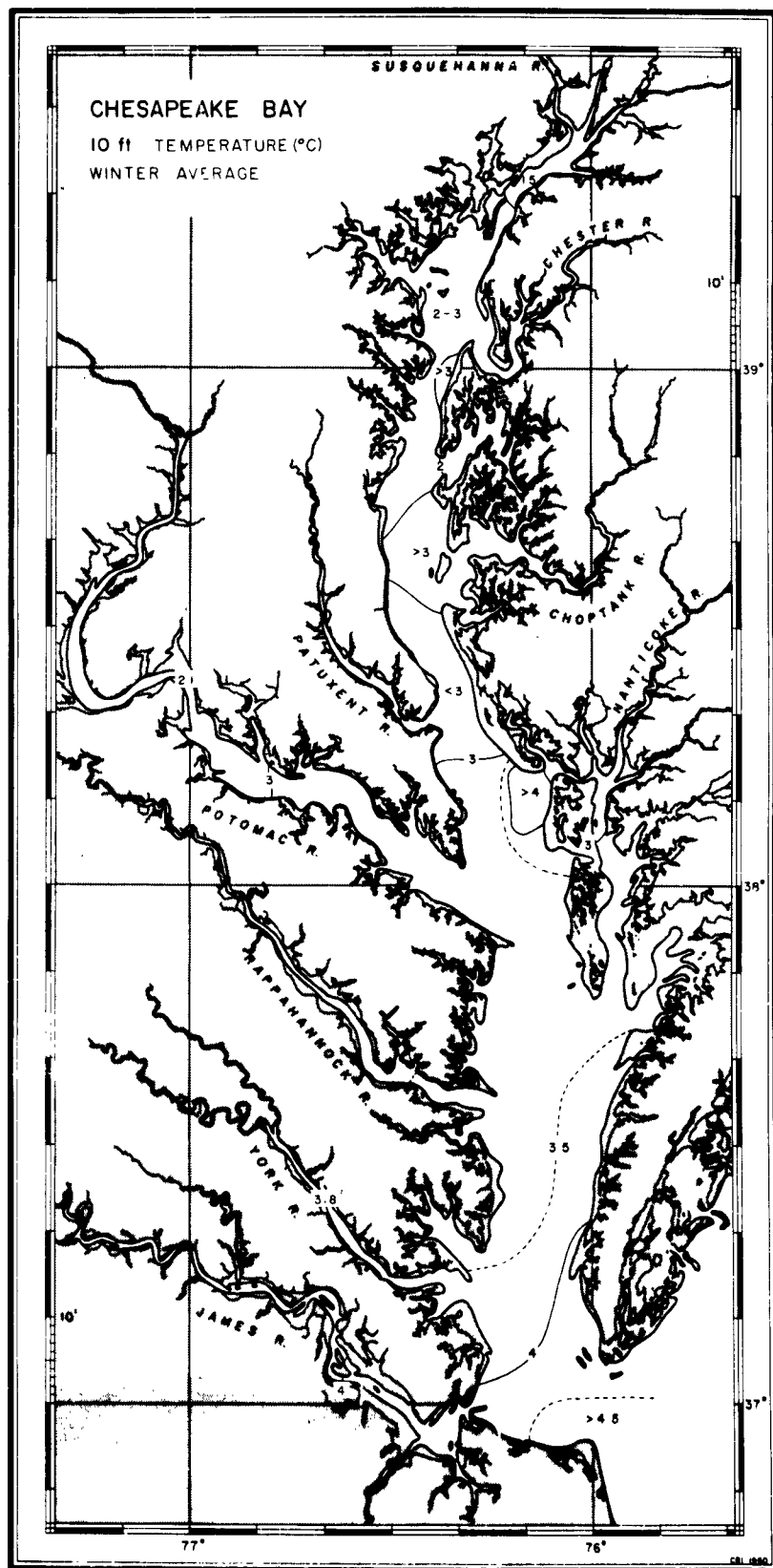
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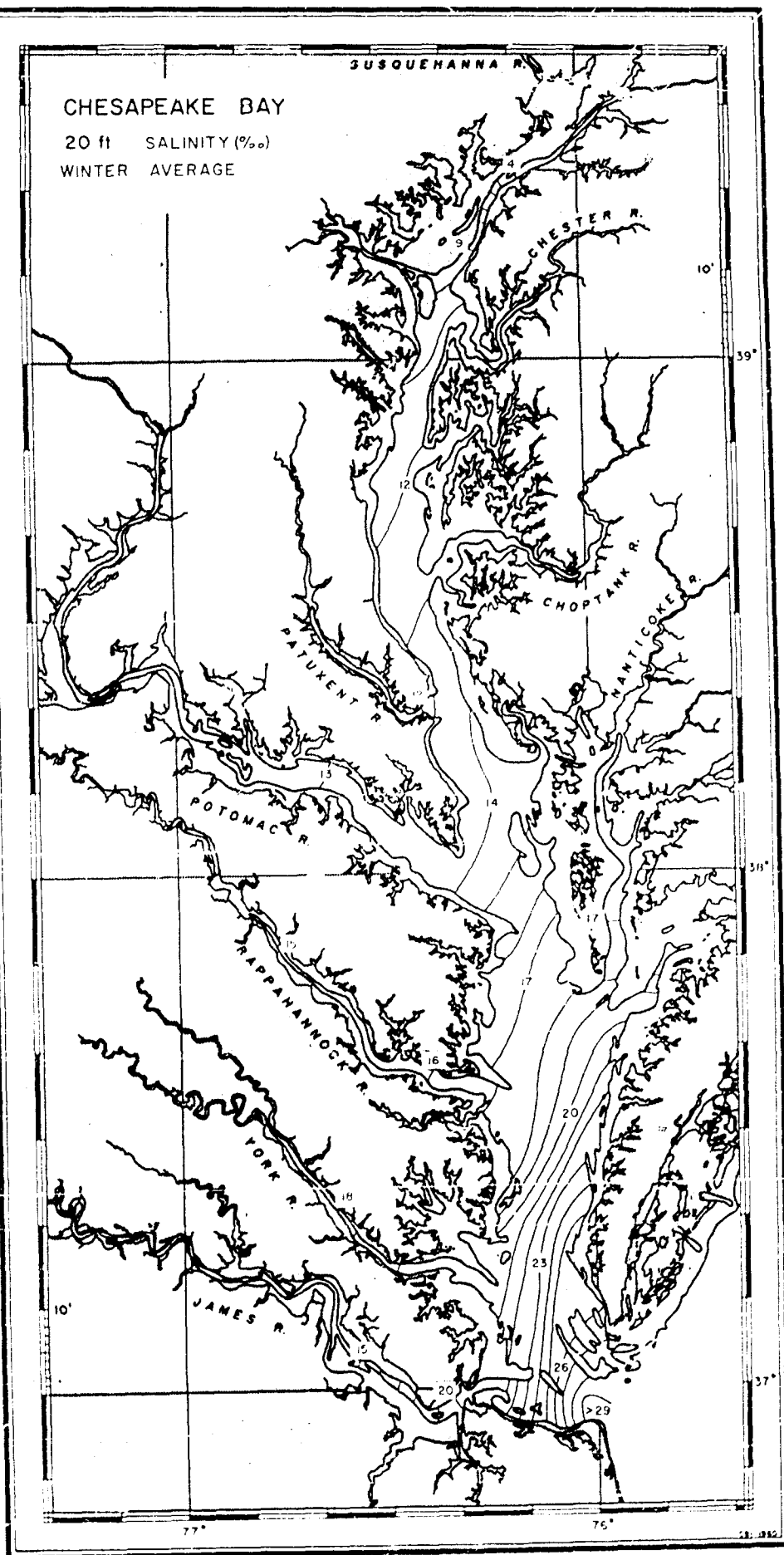
PART II

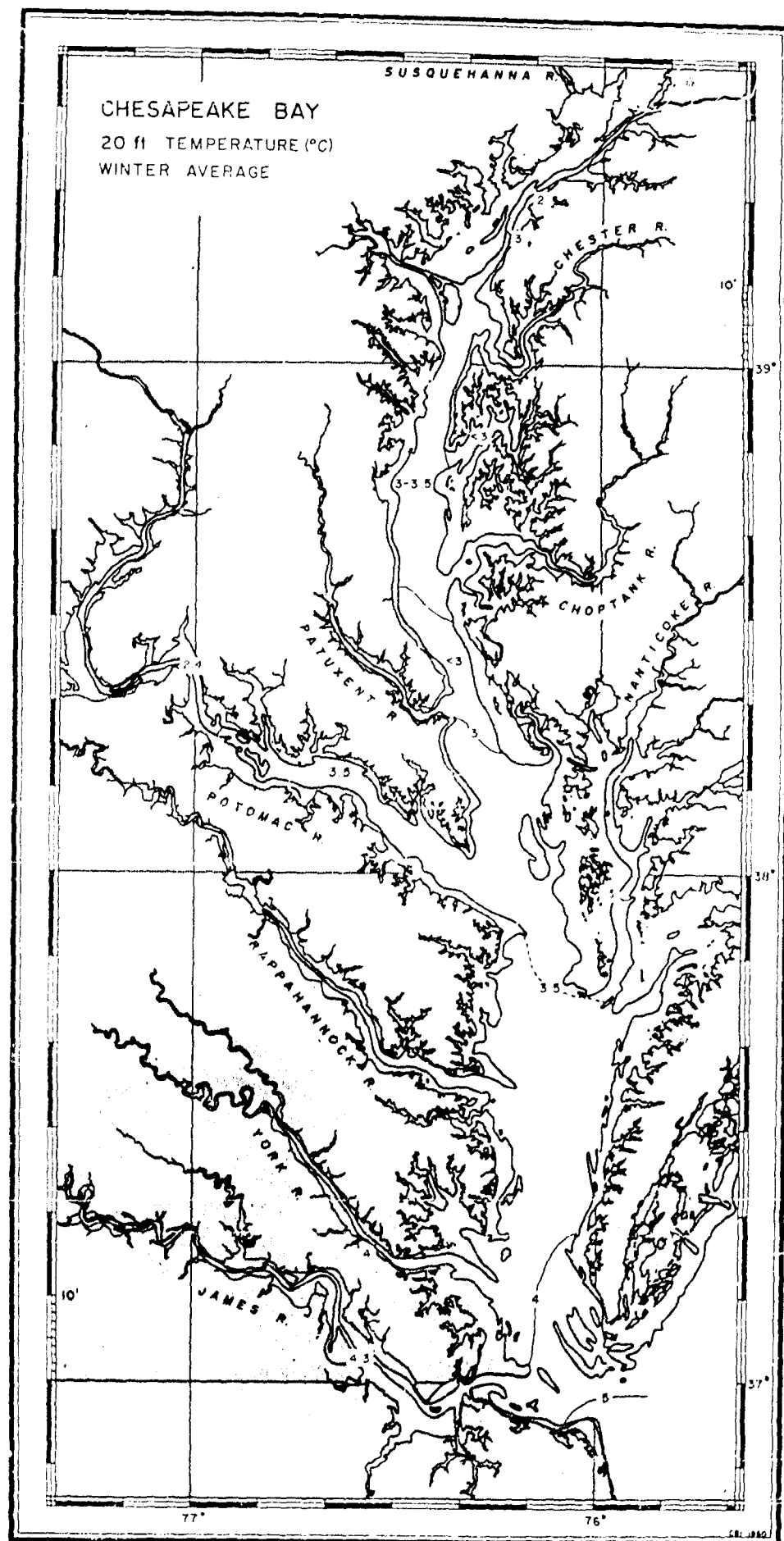


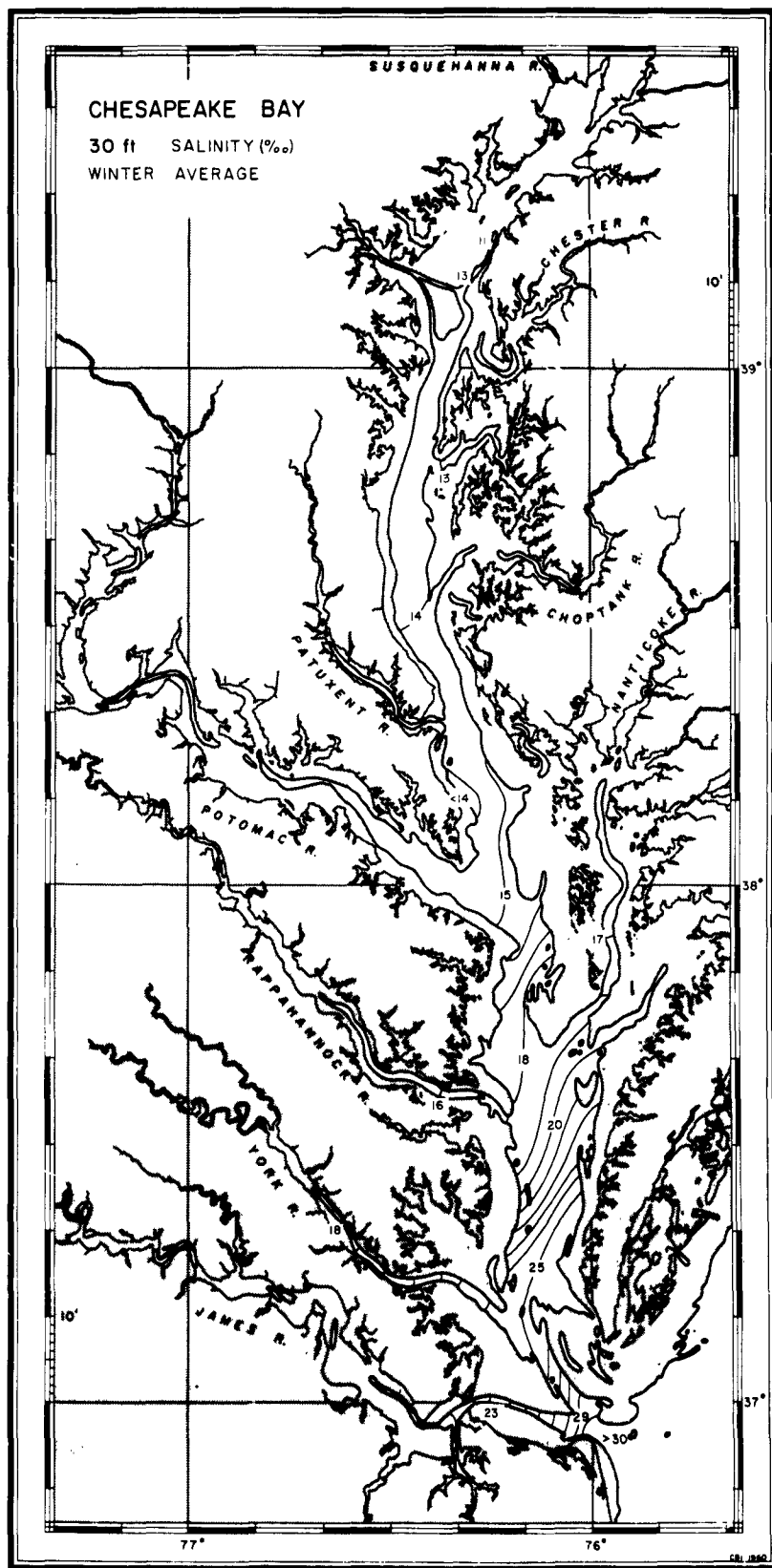


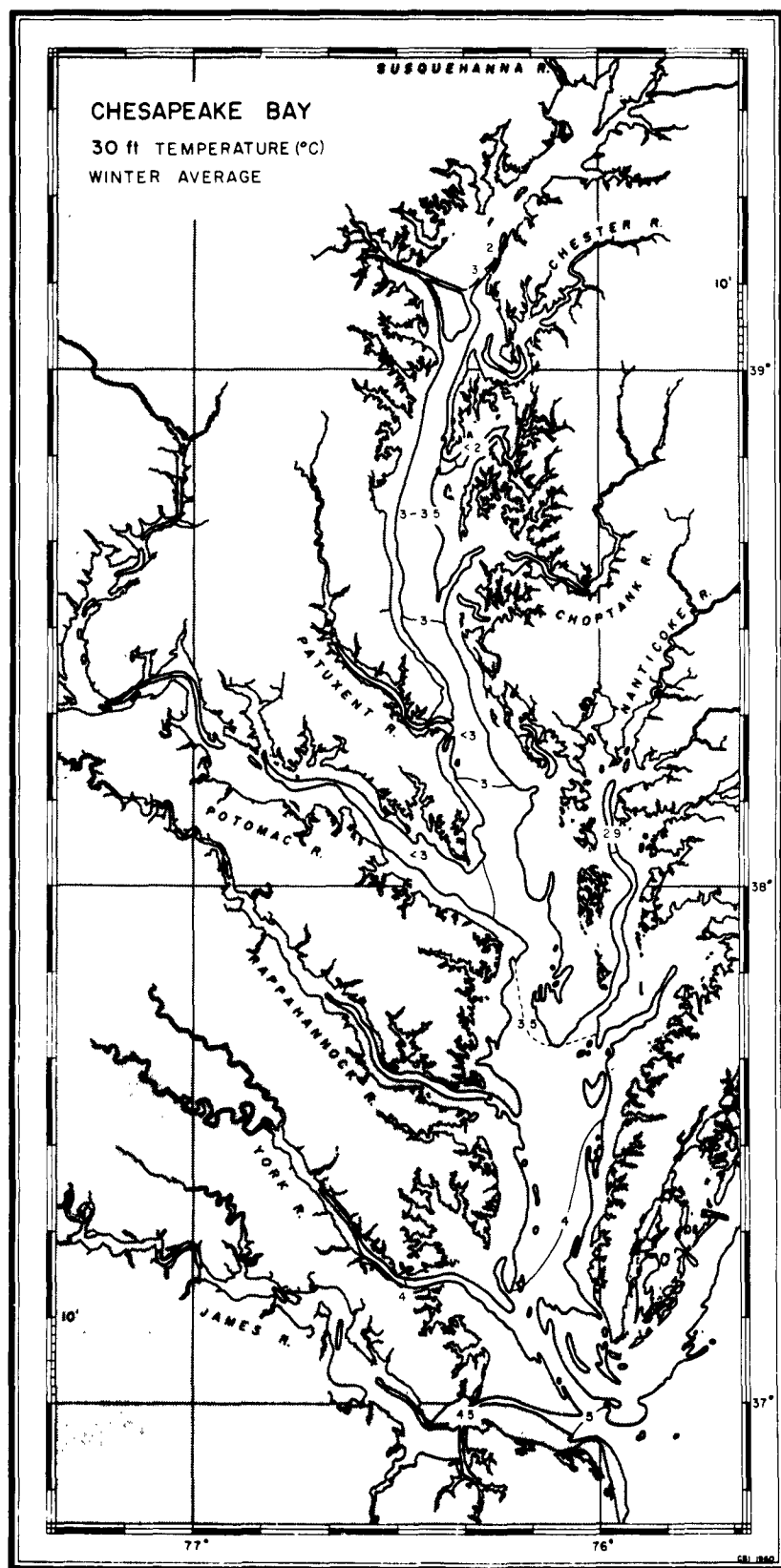


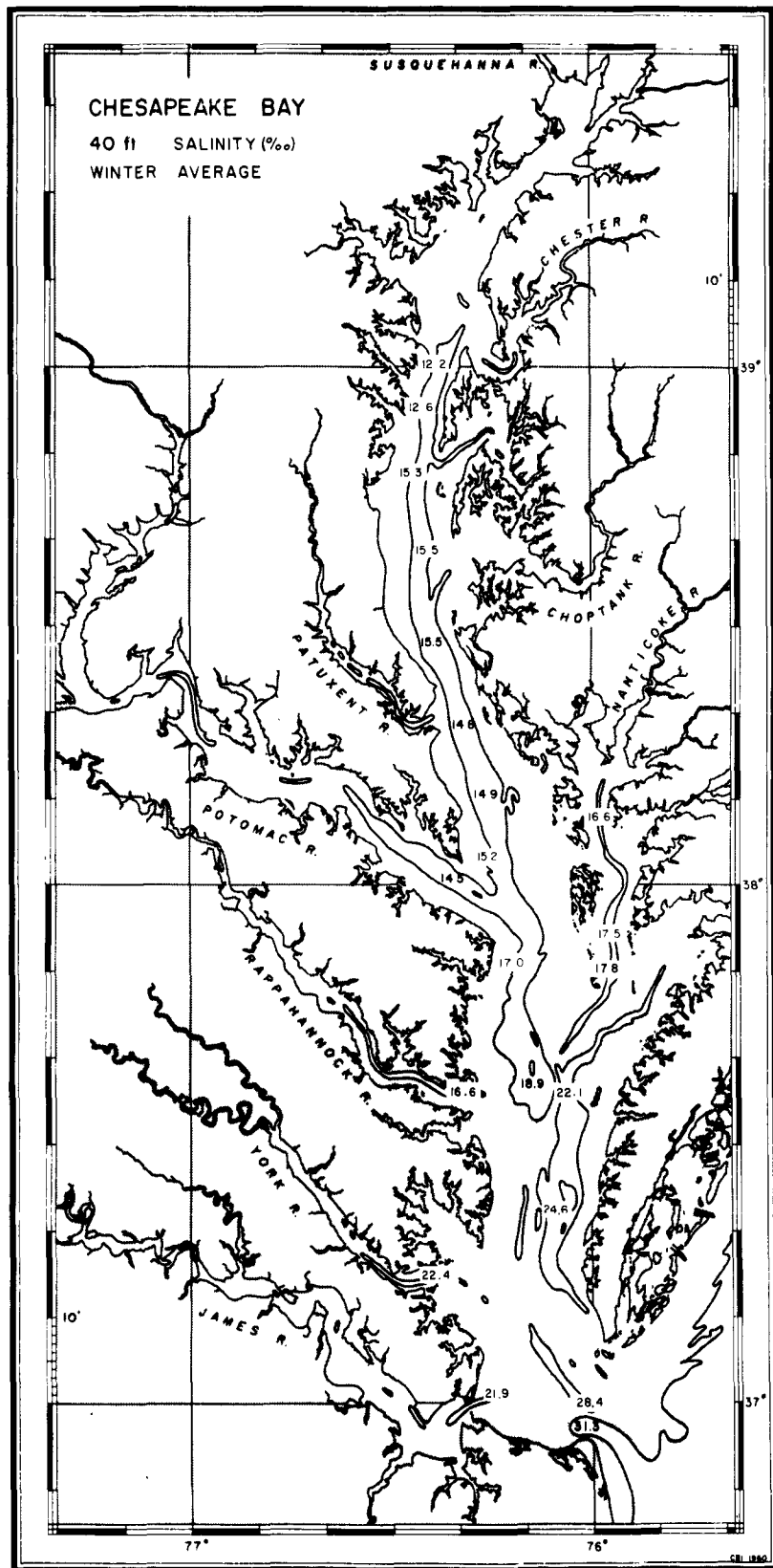


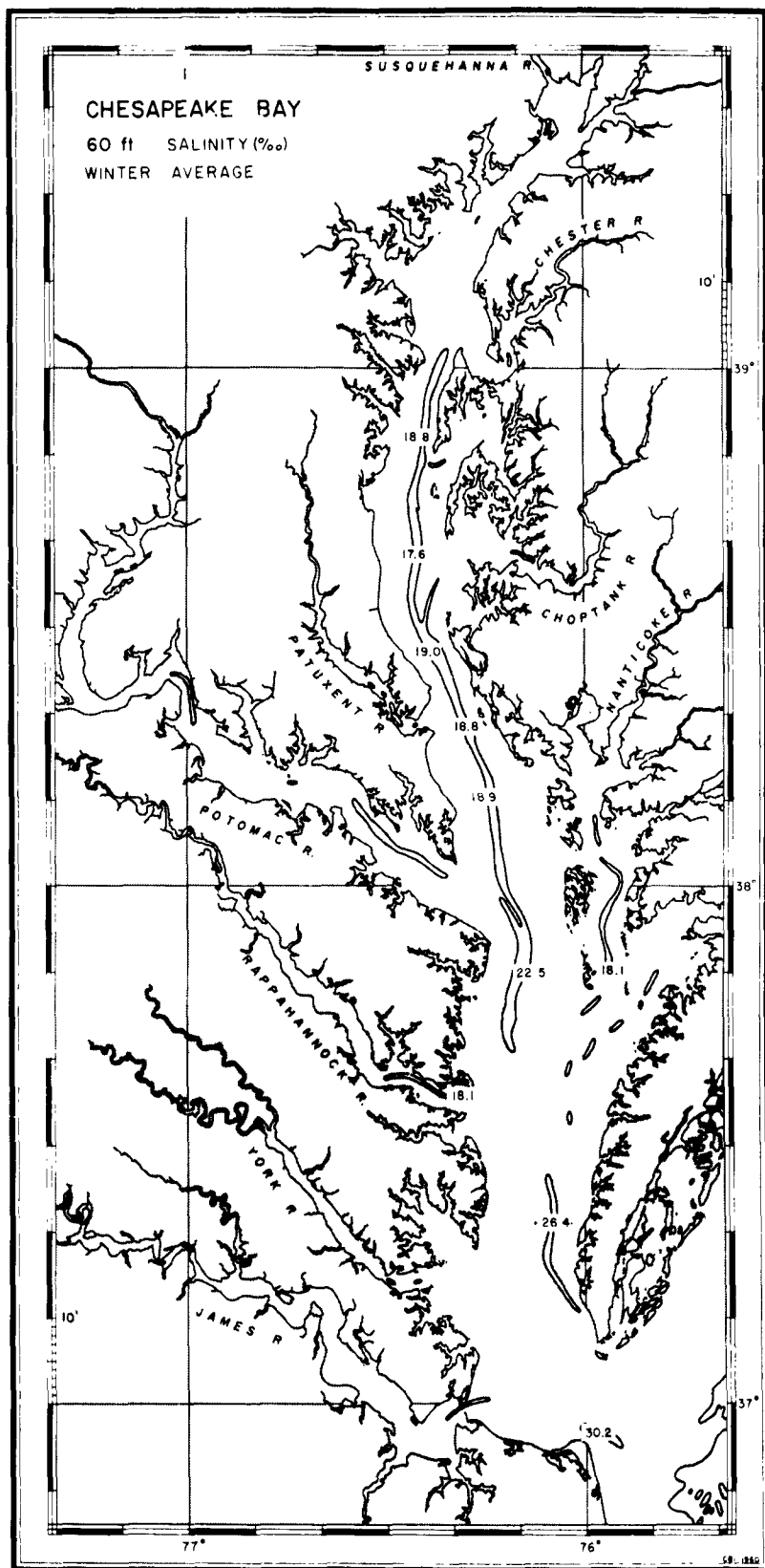


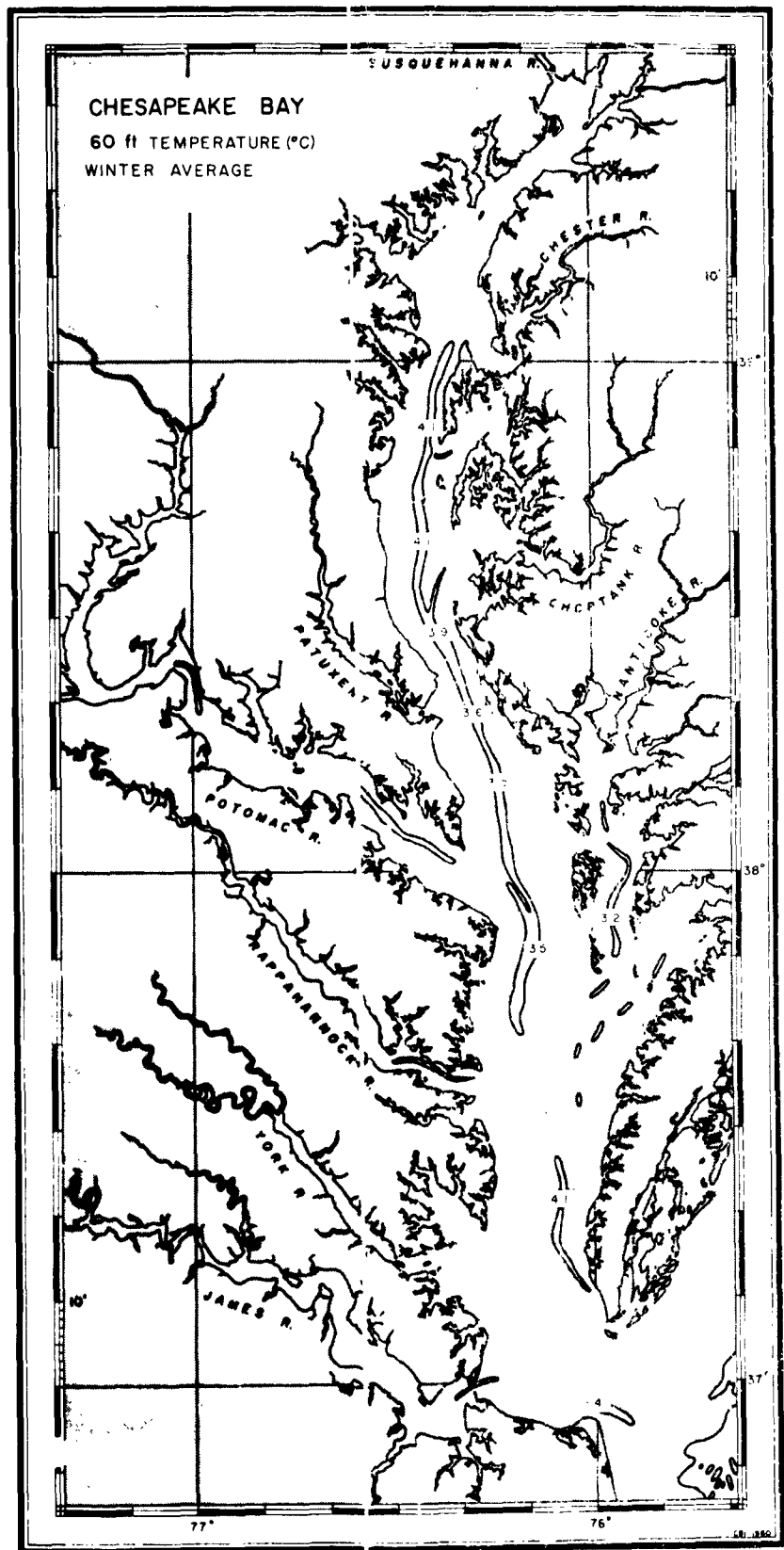




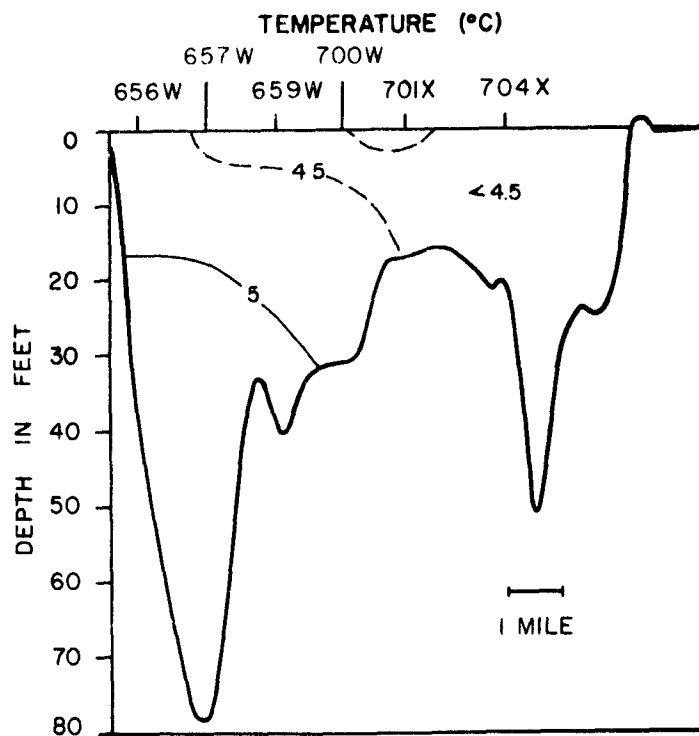
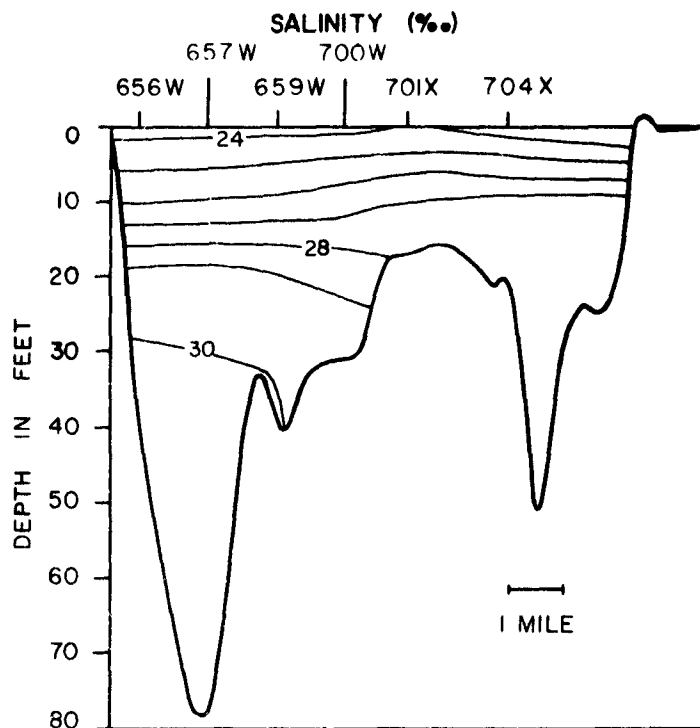




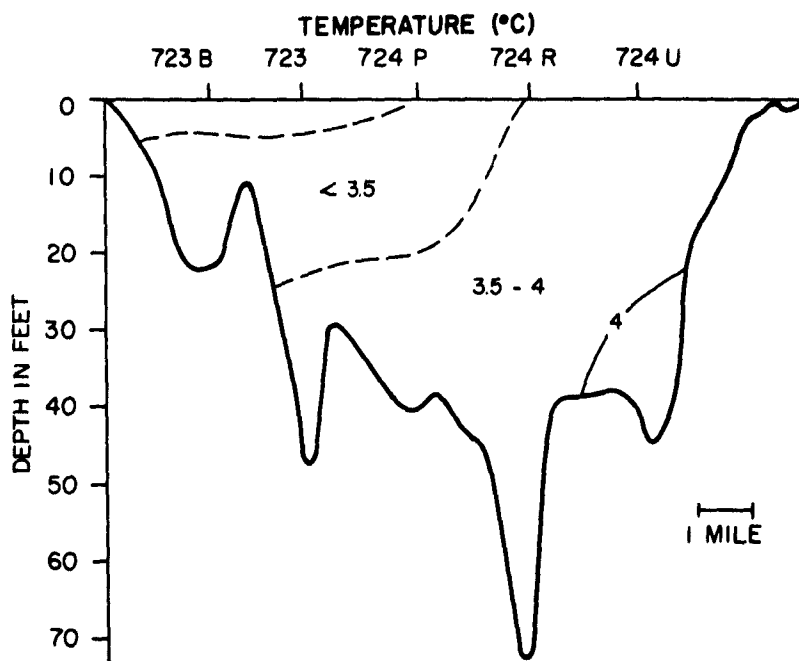
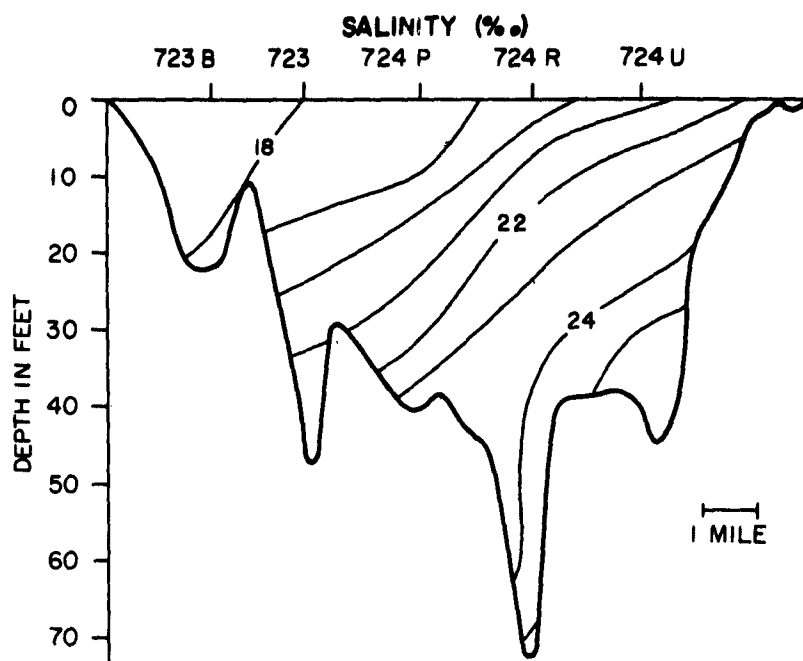




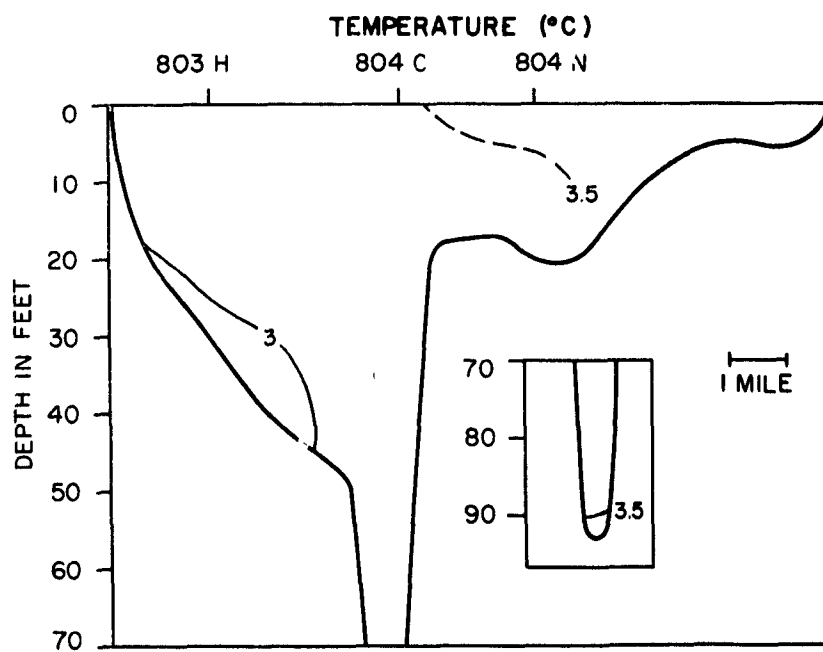
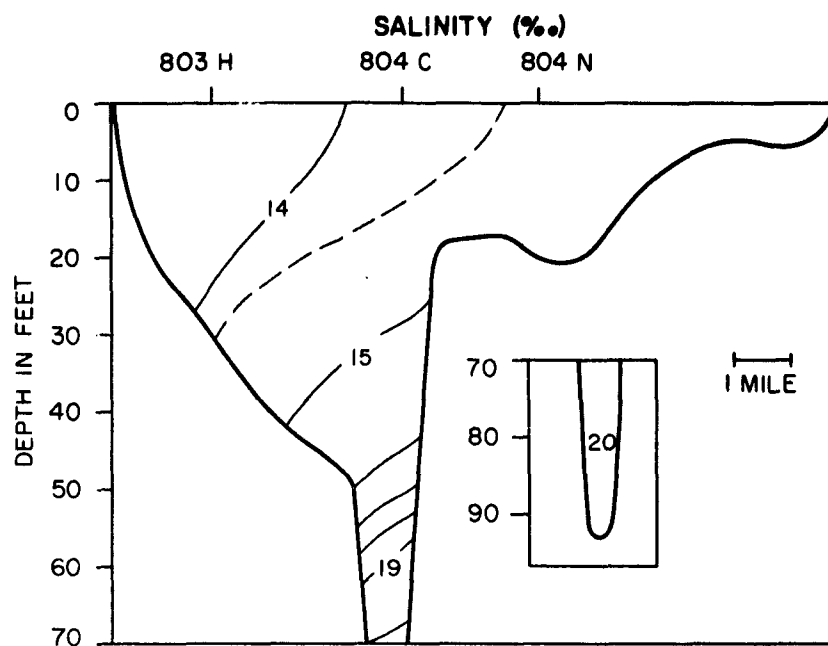
WINTER AVERAGE SECTION II



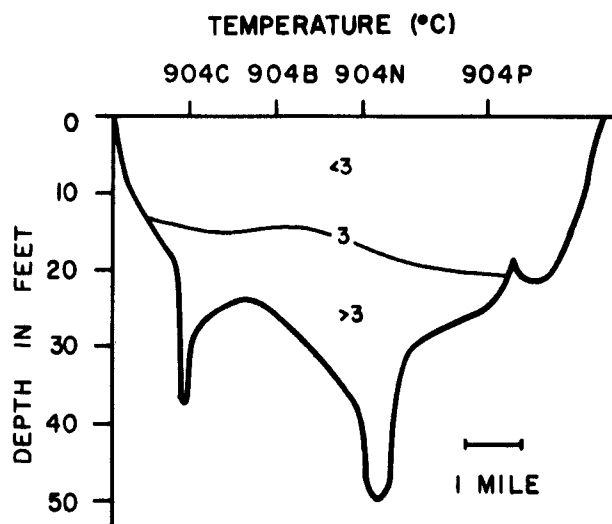
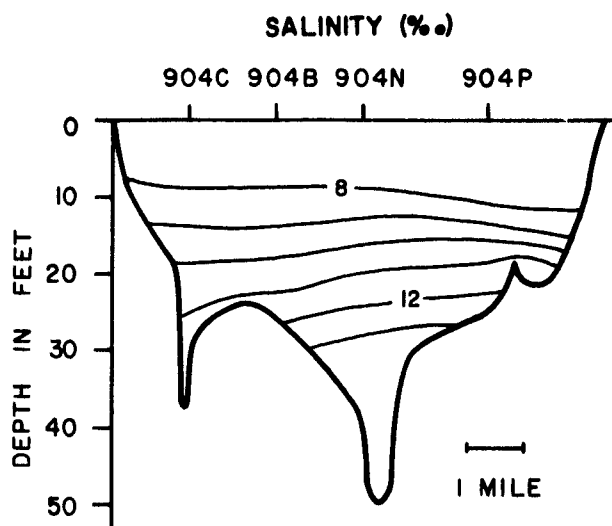
WINTER AVERAGE SECTION IV



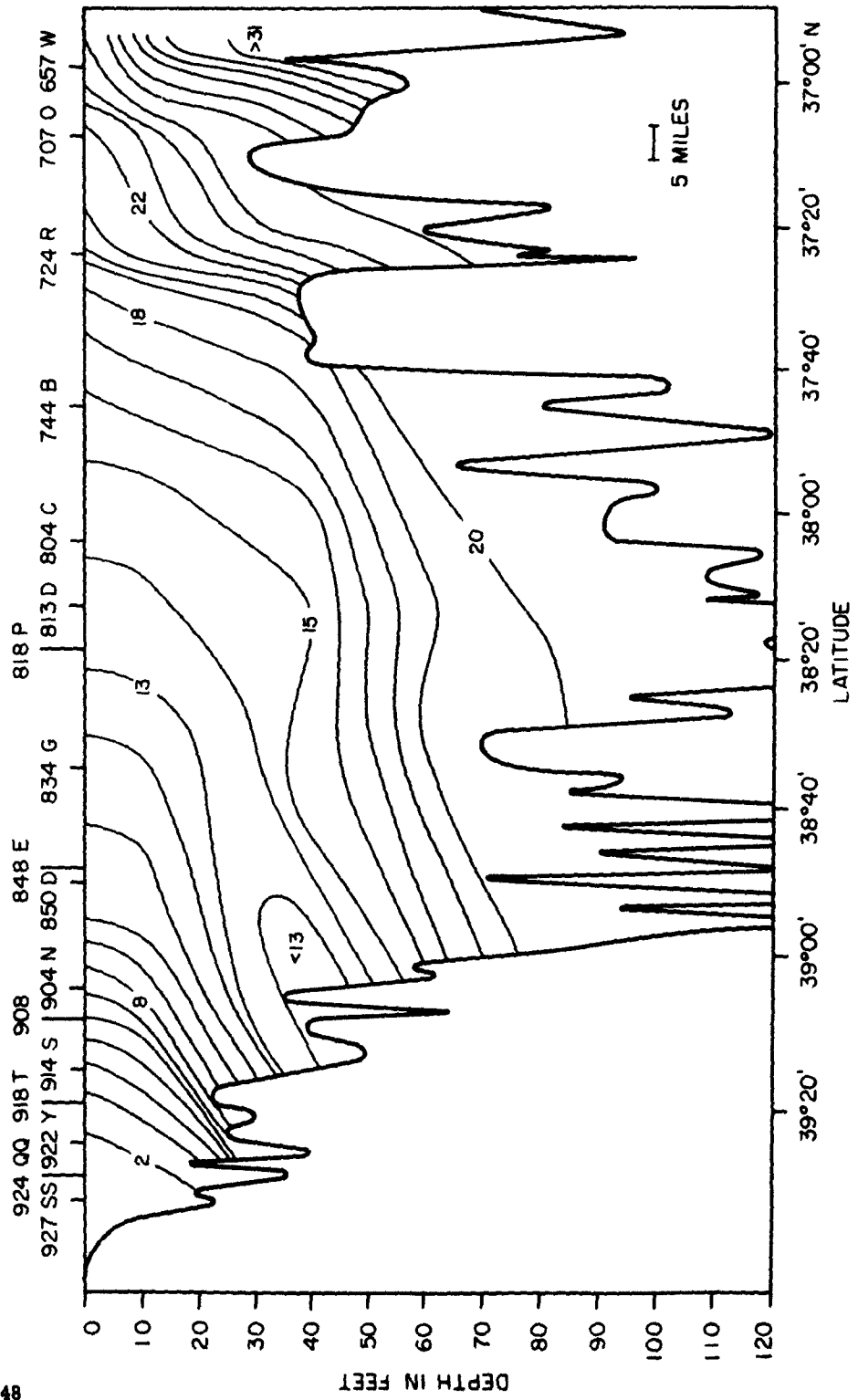
WINTER AVERAGE SECTION VI



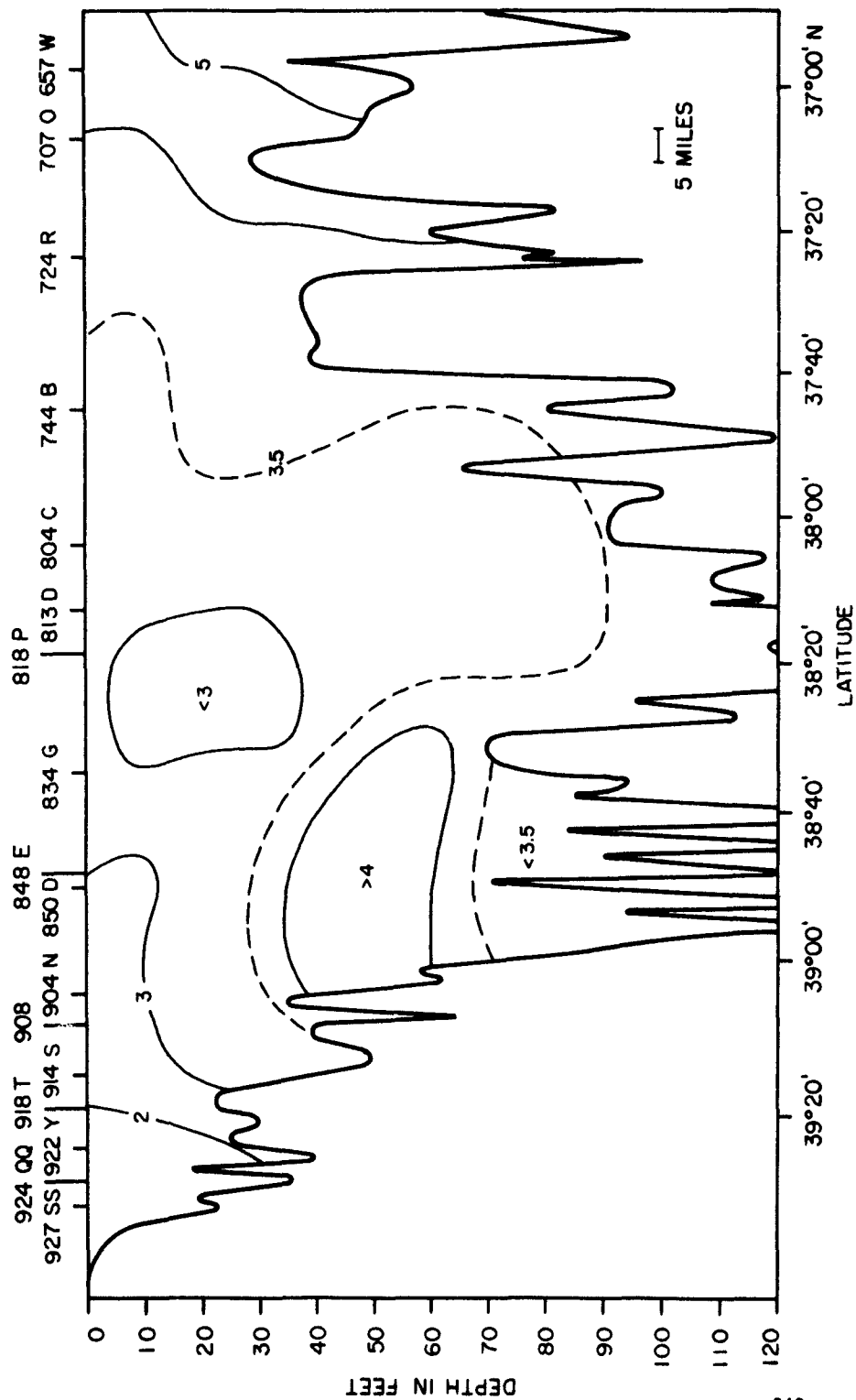
WINTER AVERAGE SECTION X

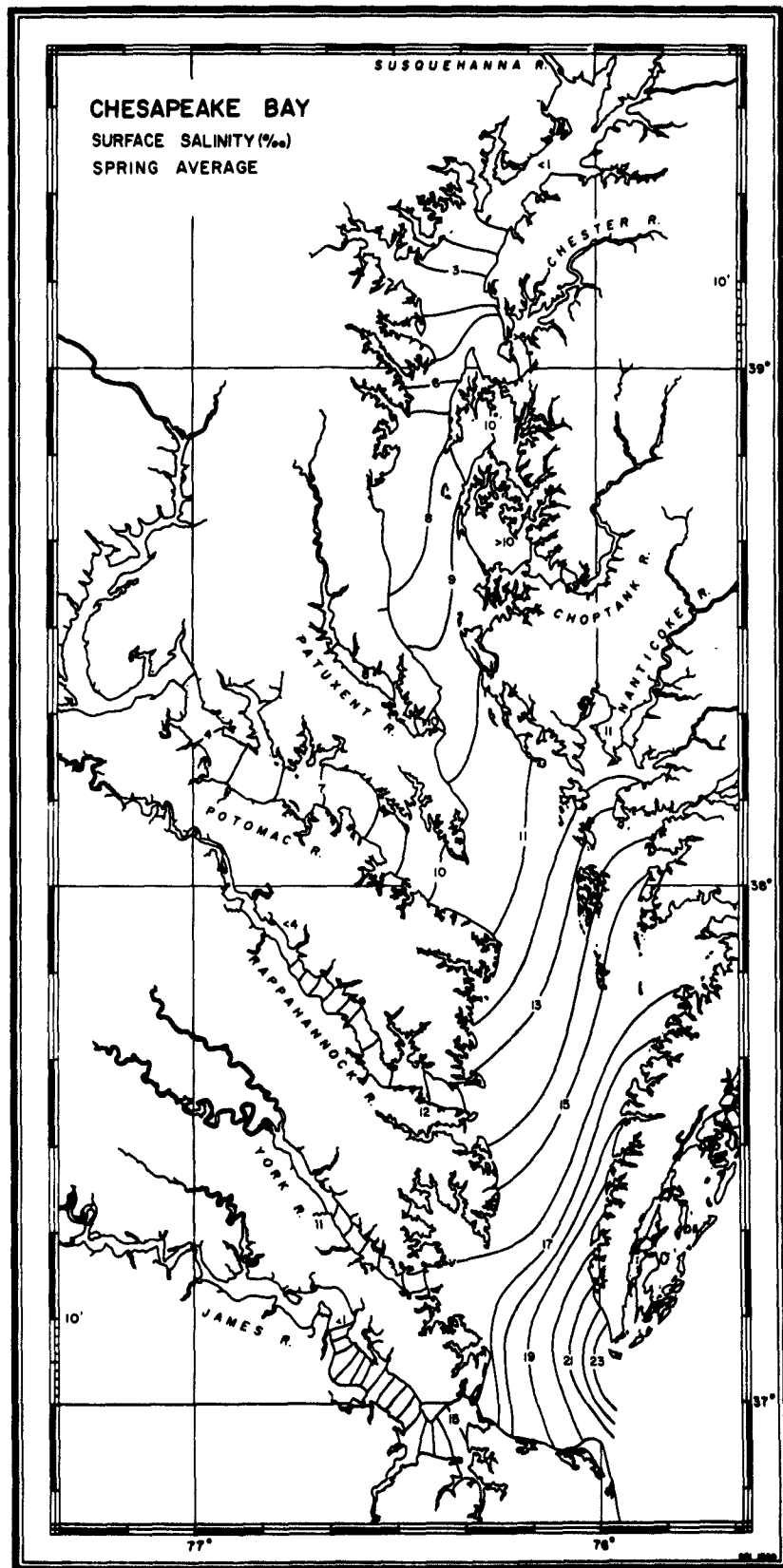


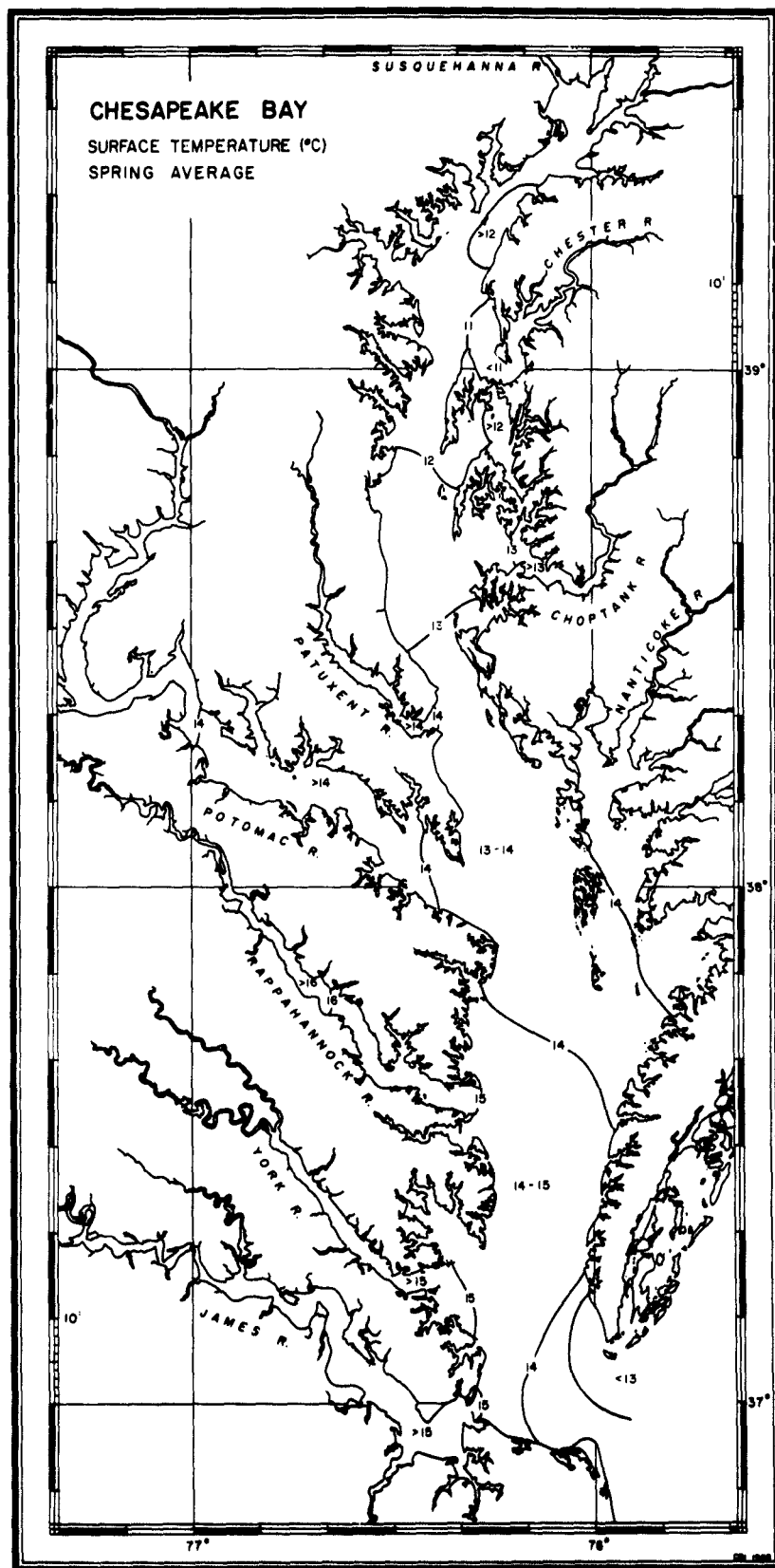
WINTER AVERAGE SECTION XIX SALINITY (‰)

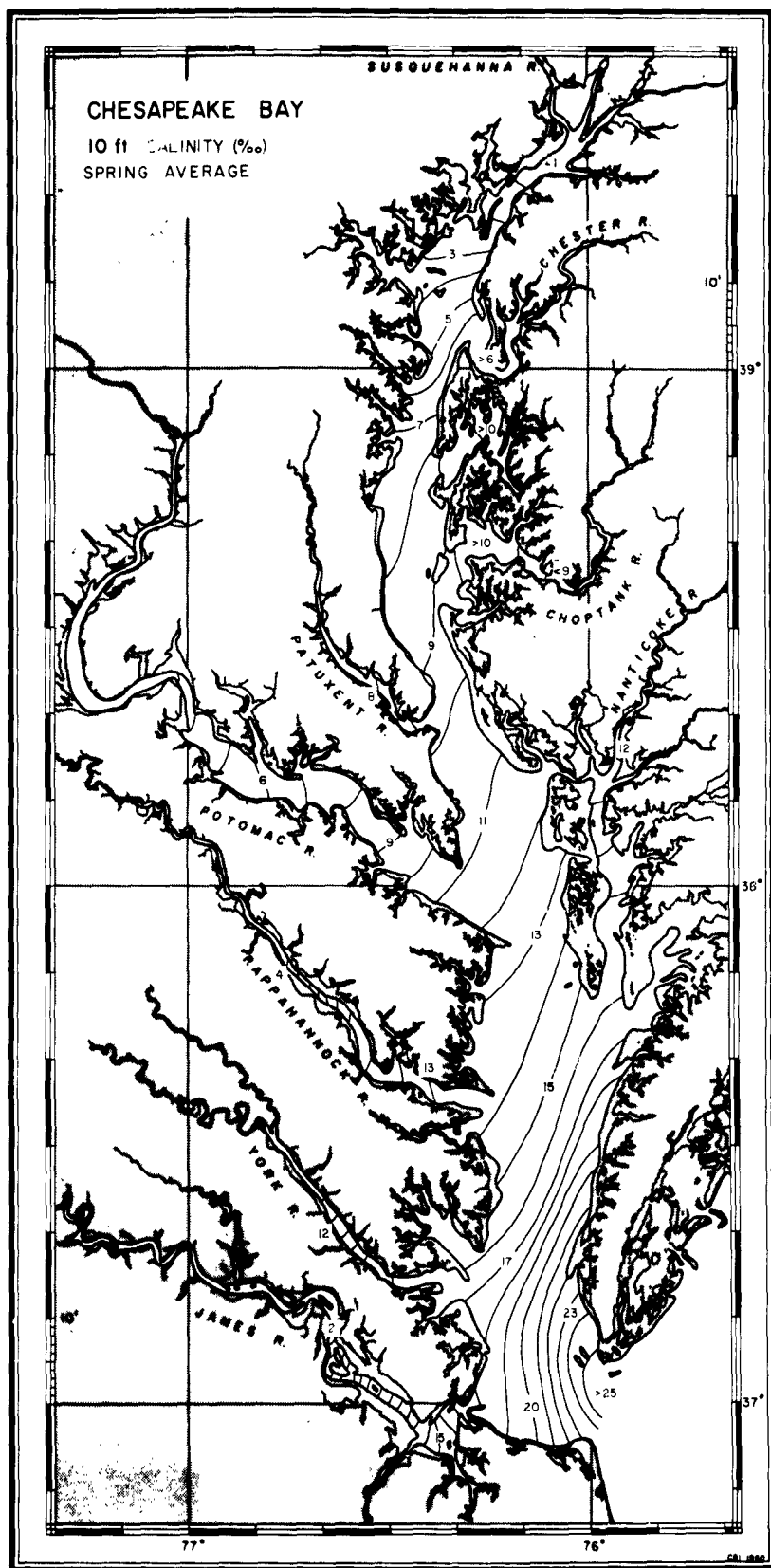


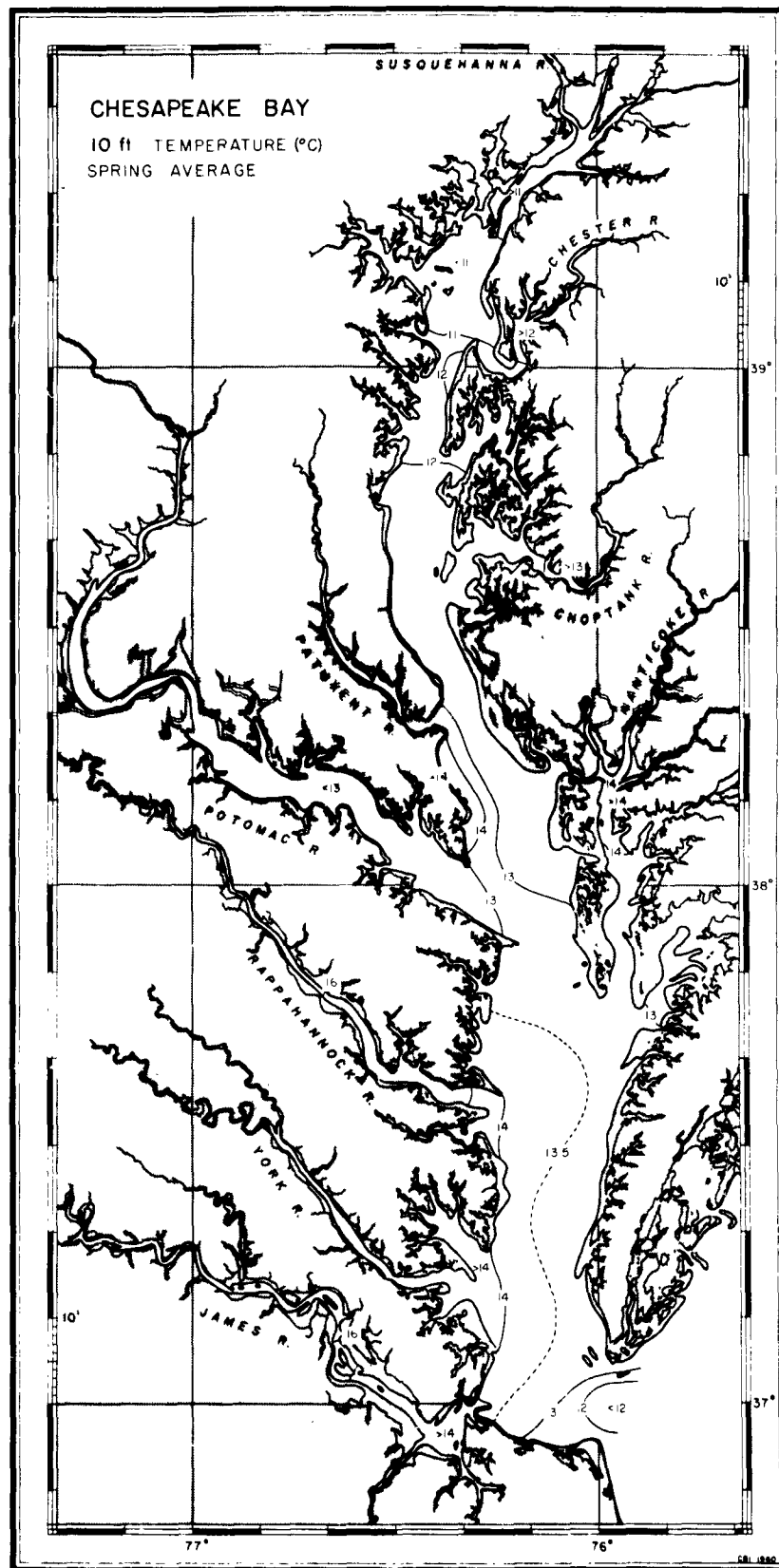
WINTER AVERAGE SECTION XIX TEMPERATURE (°C)

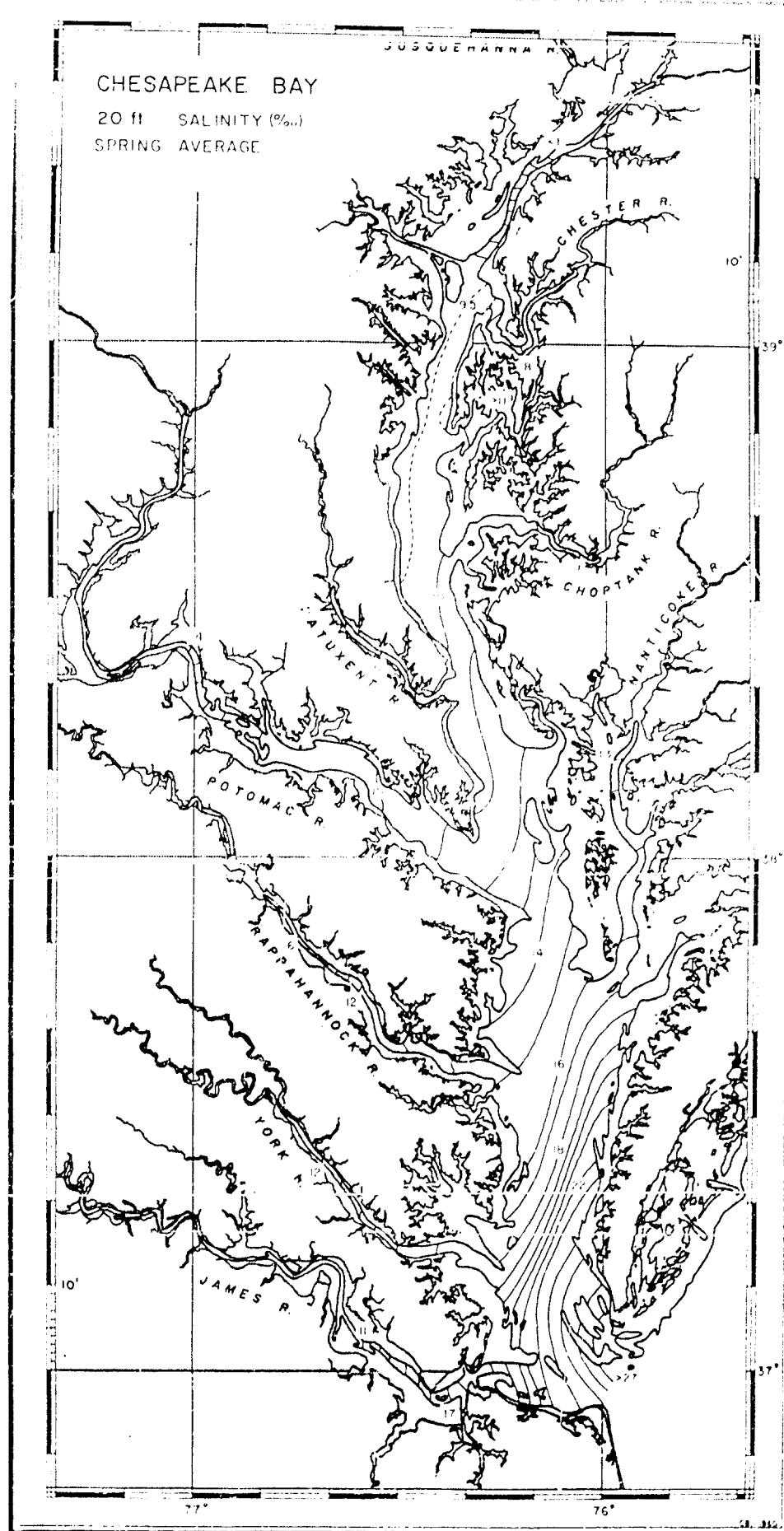


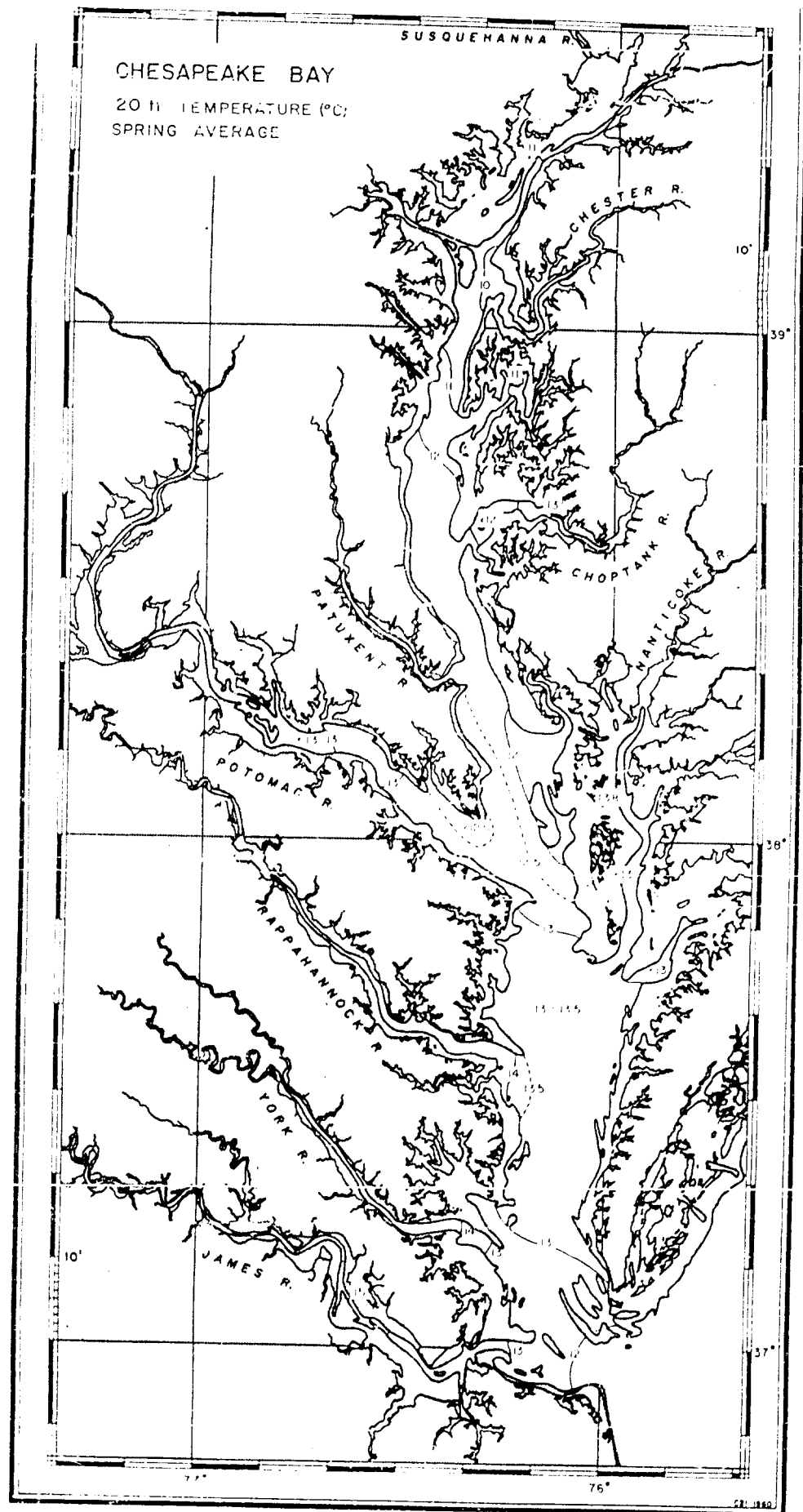


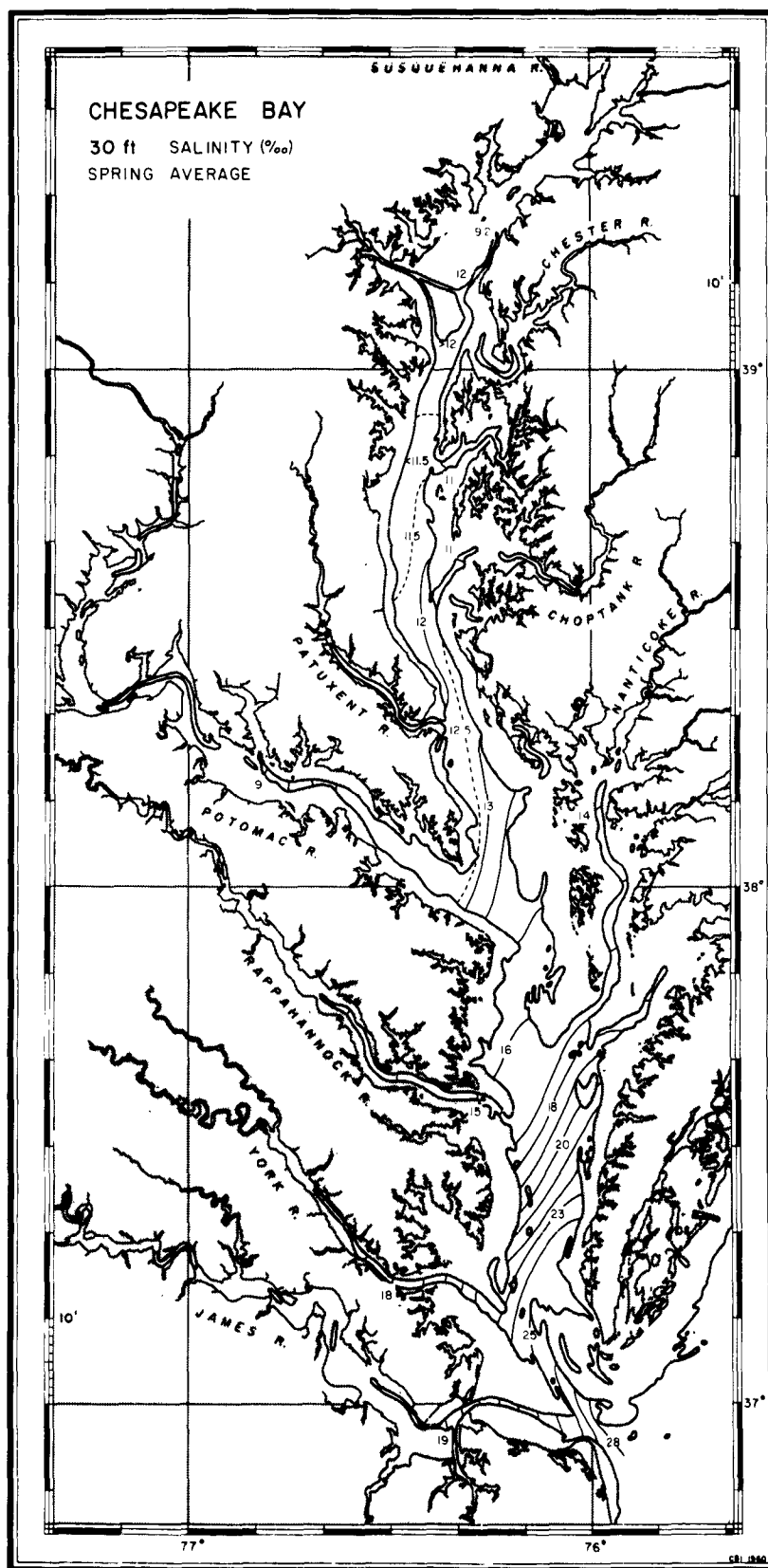


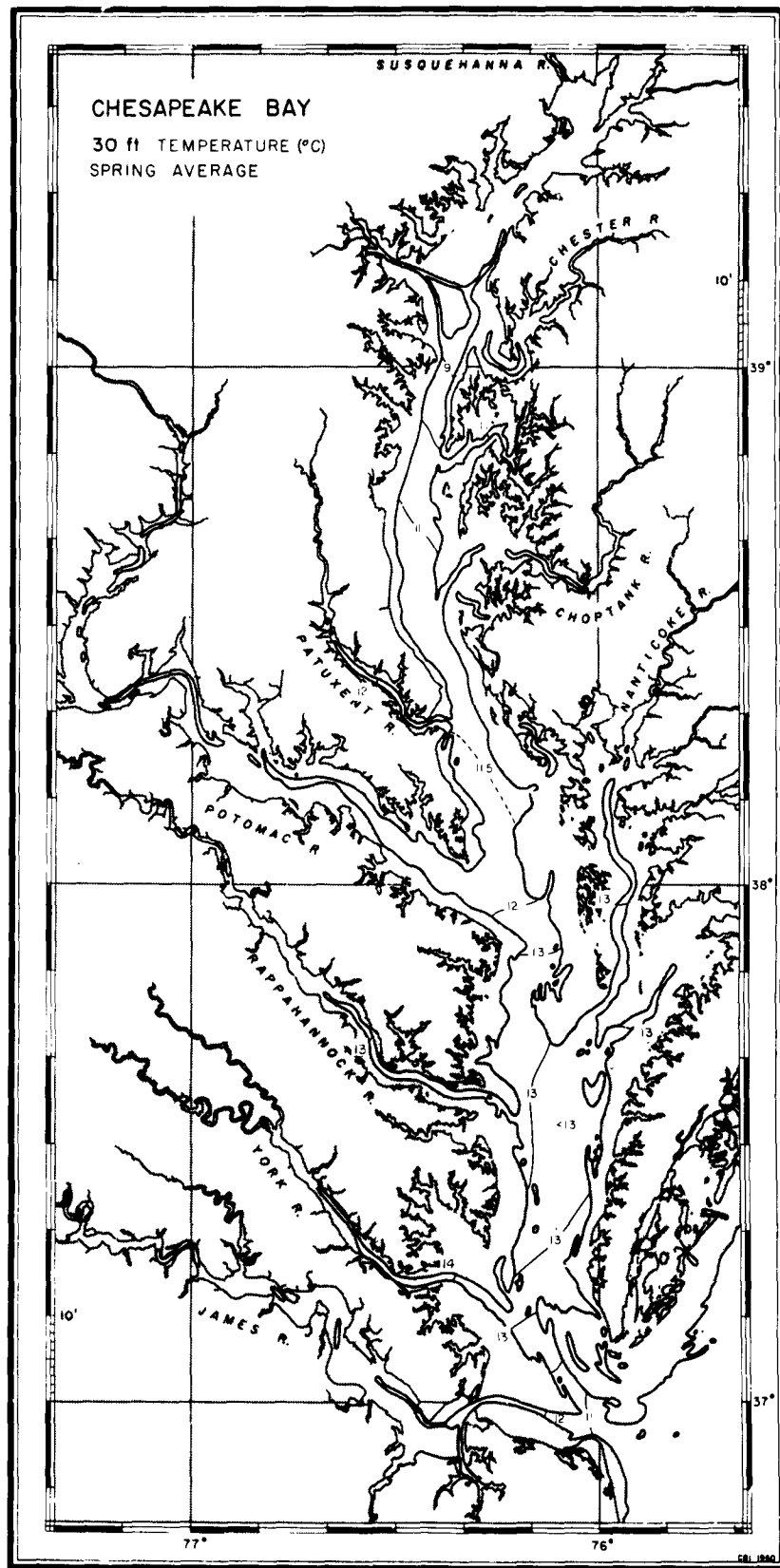


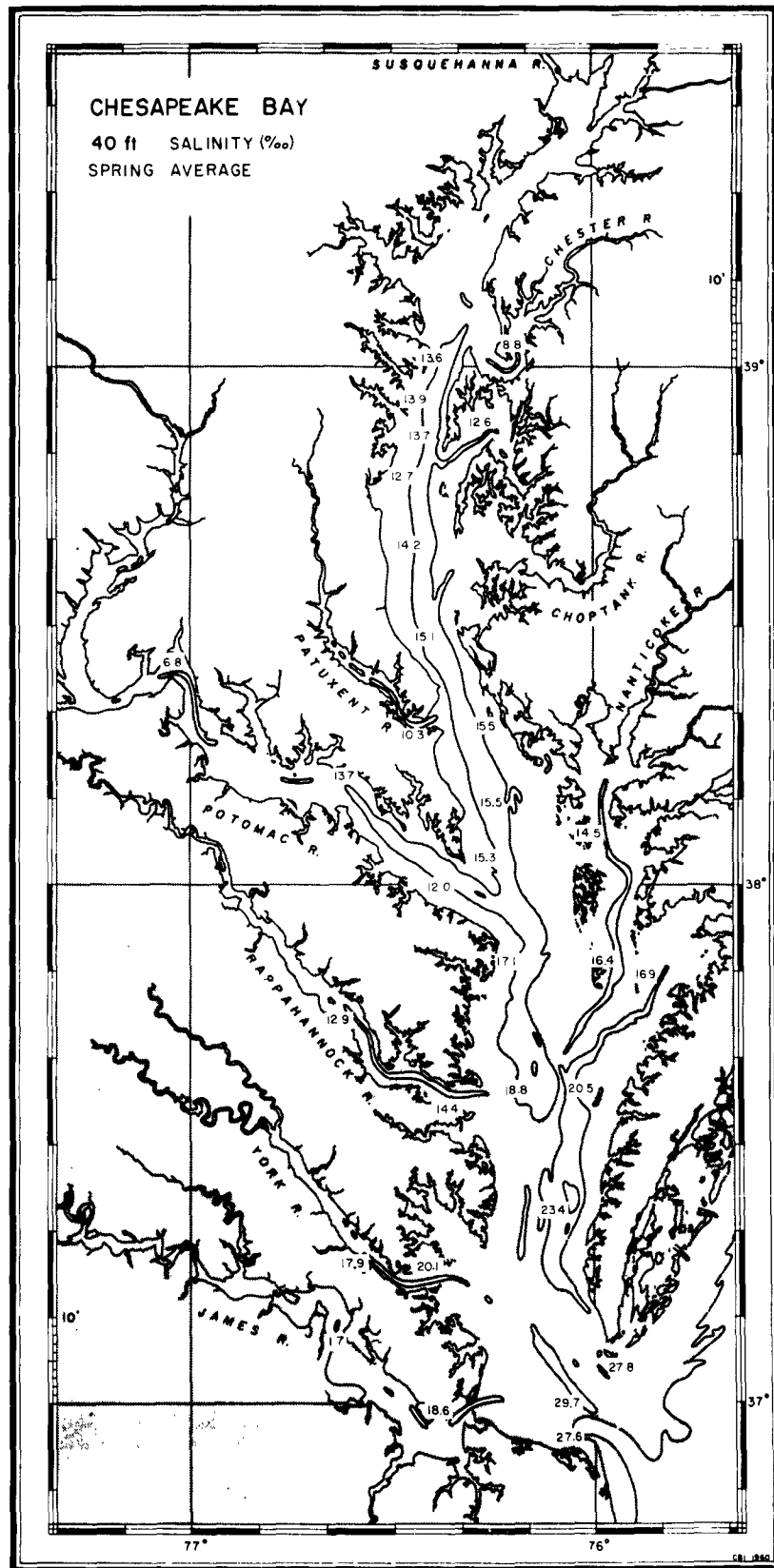


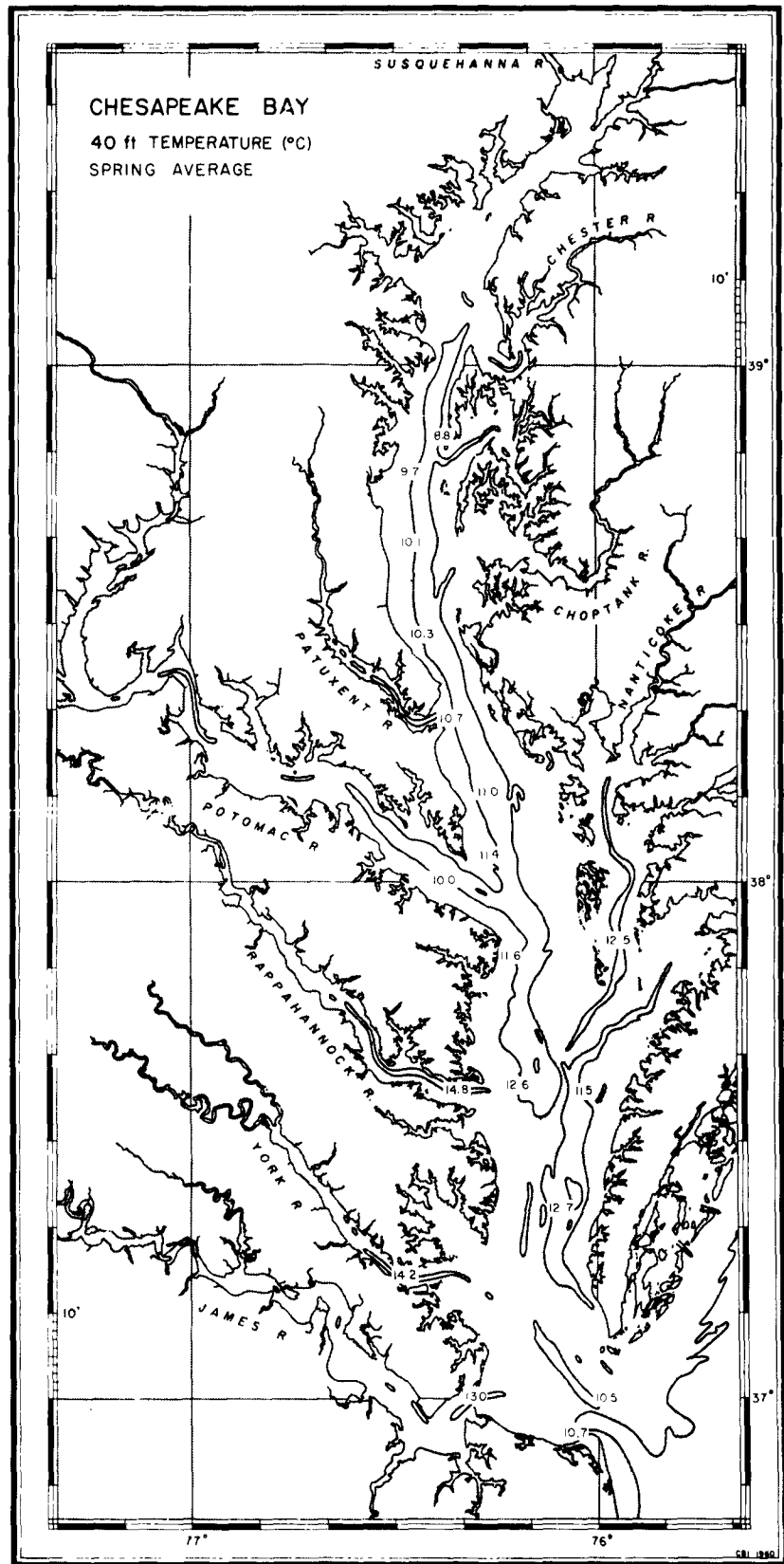


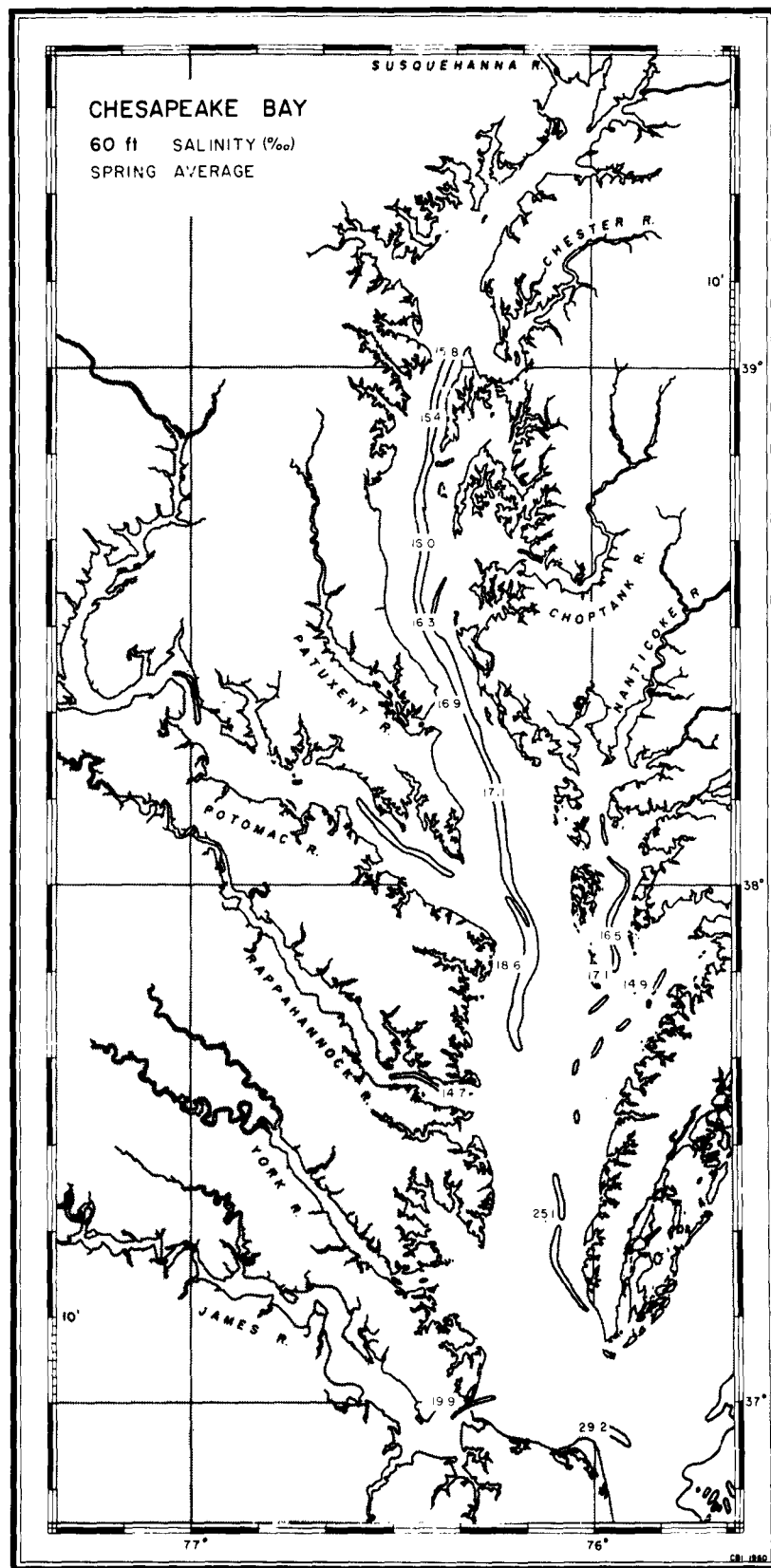


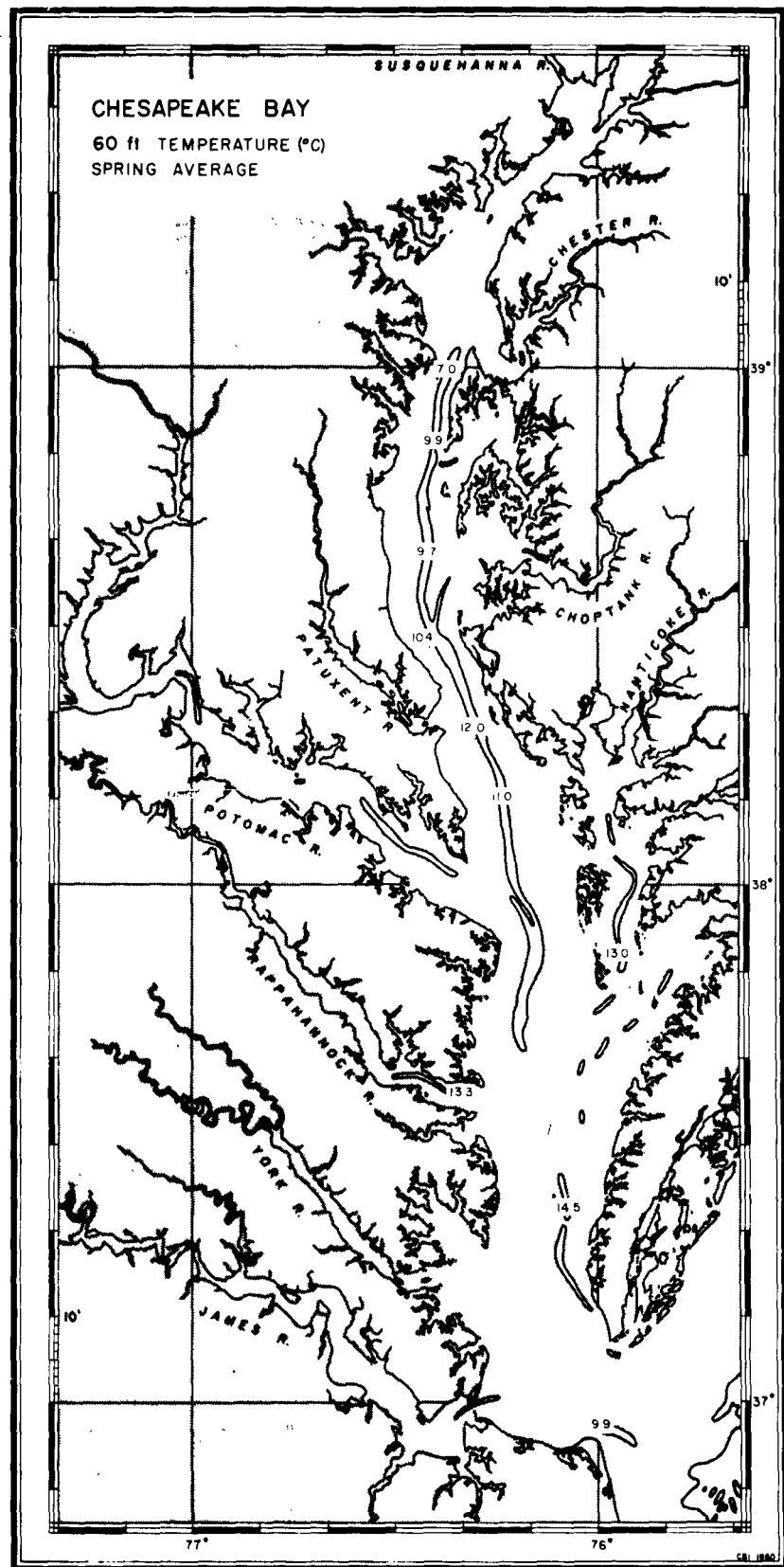




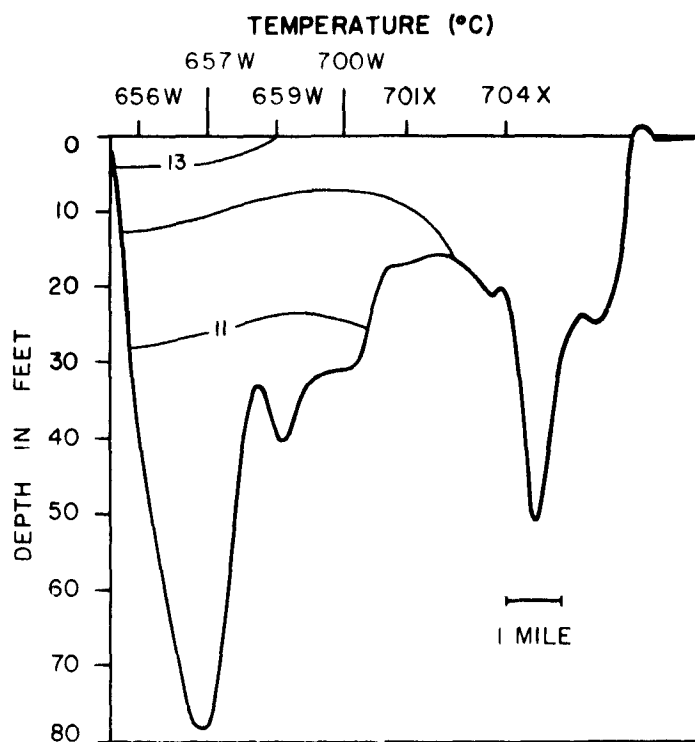
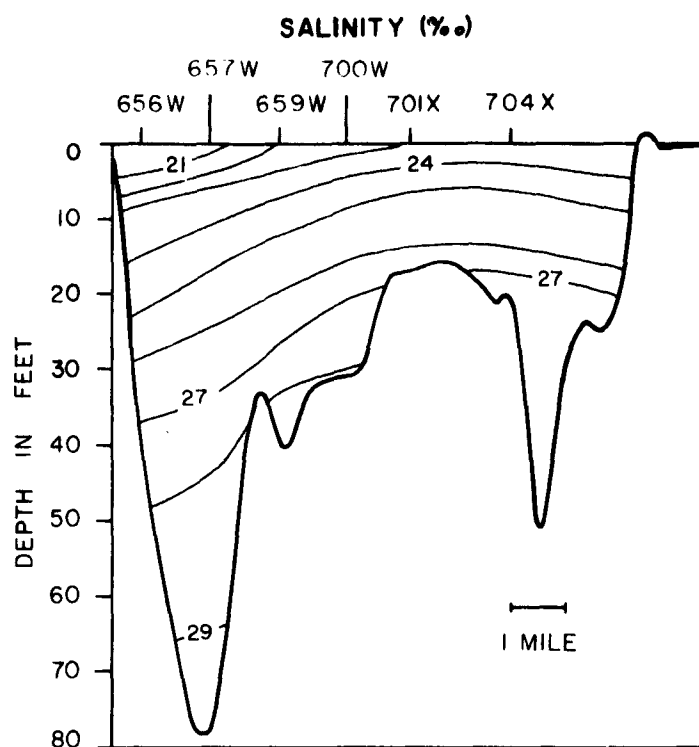




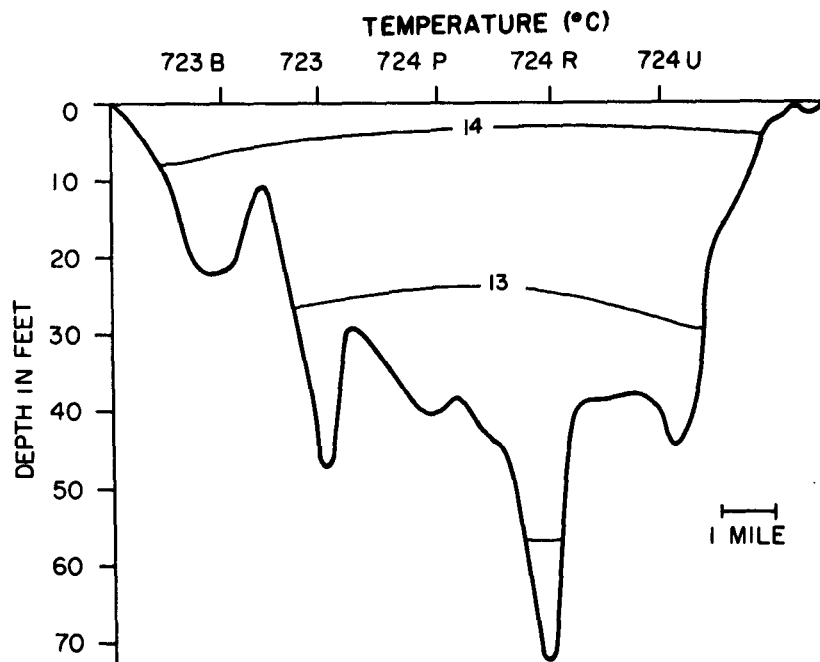
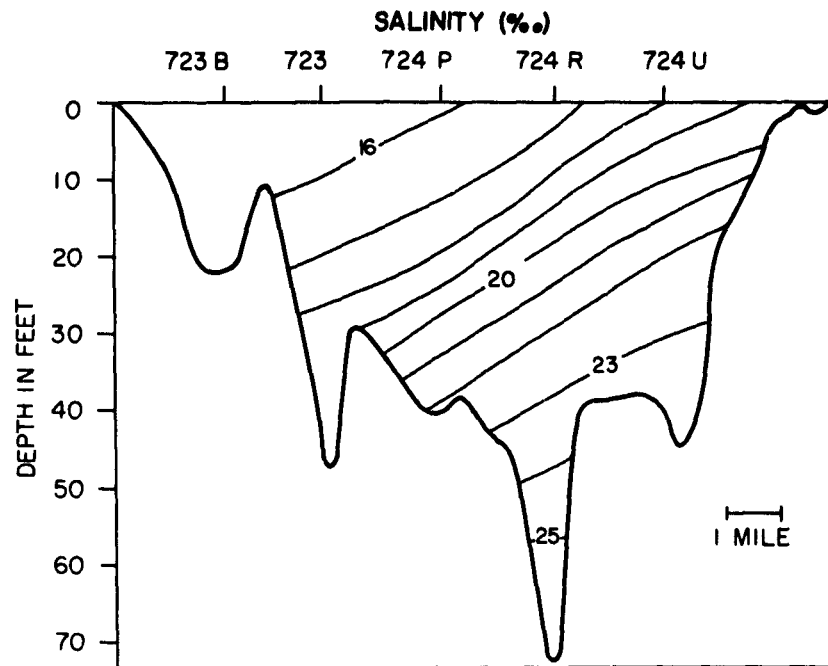




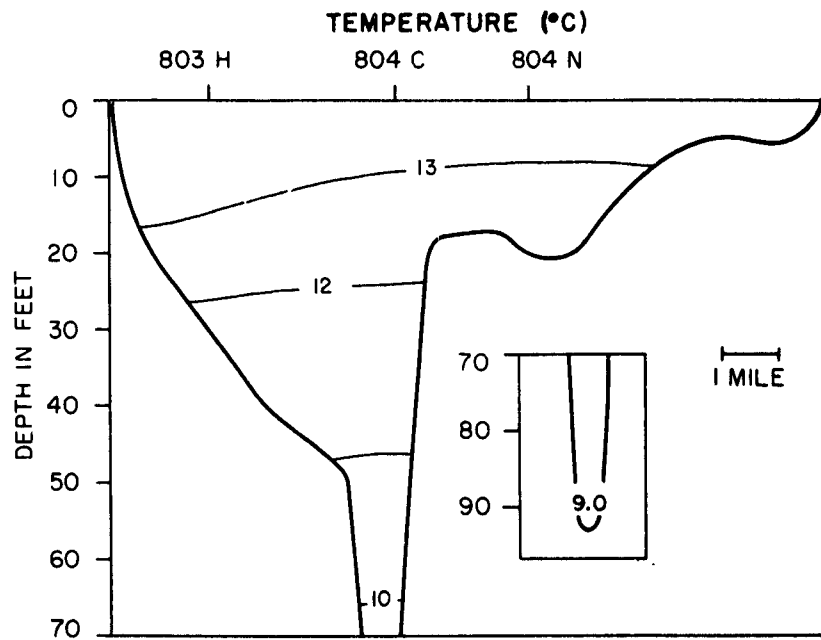
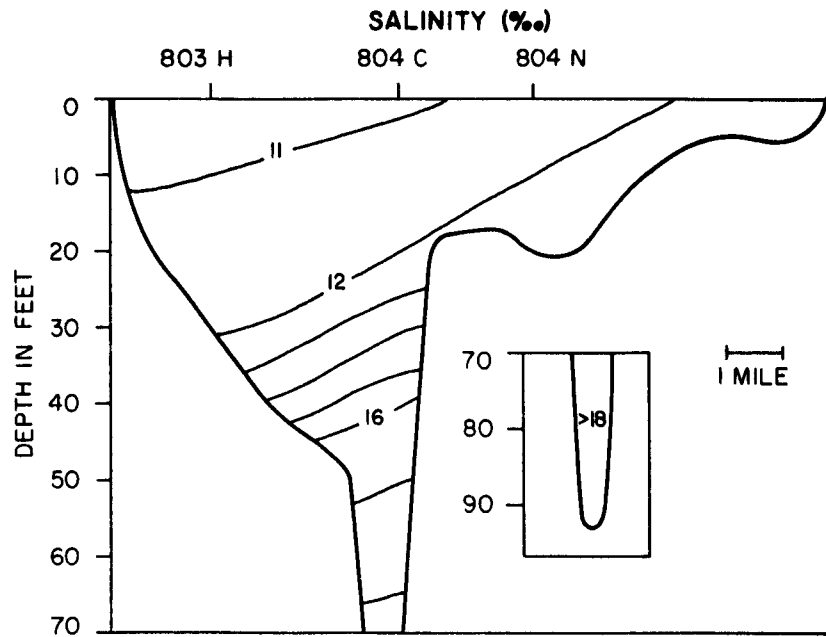
SPRING AVERAGE SECTION II



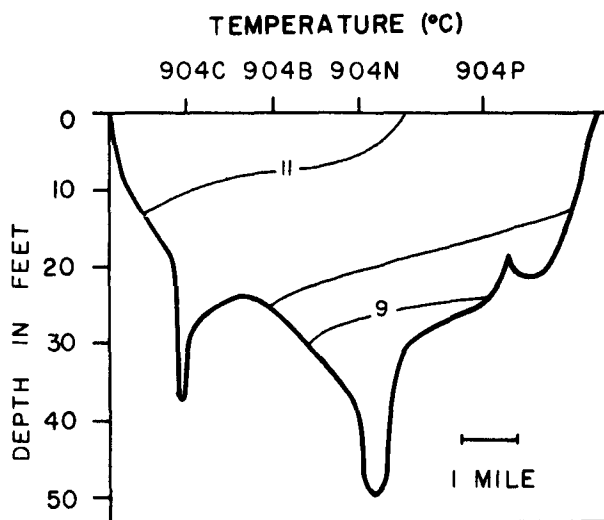
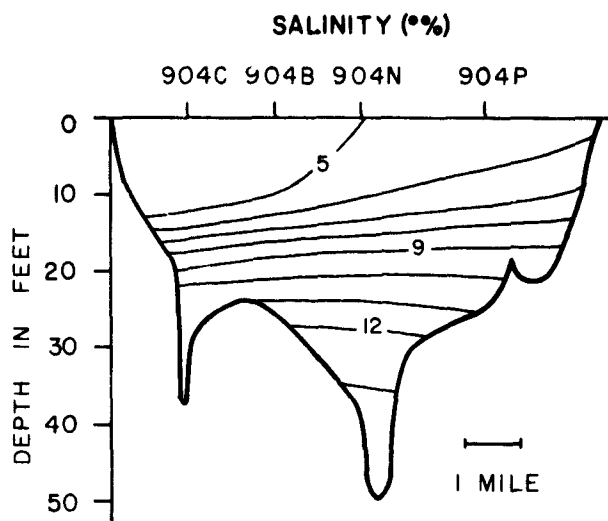
SPRING AVERAGE SECTION IV



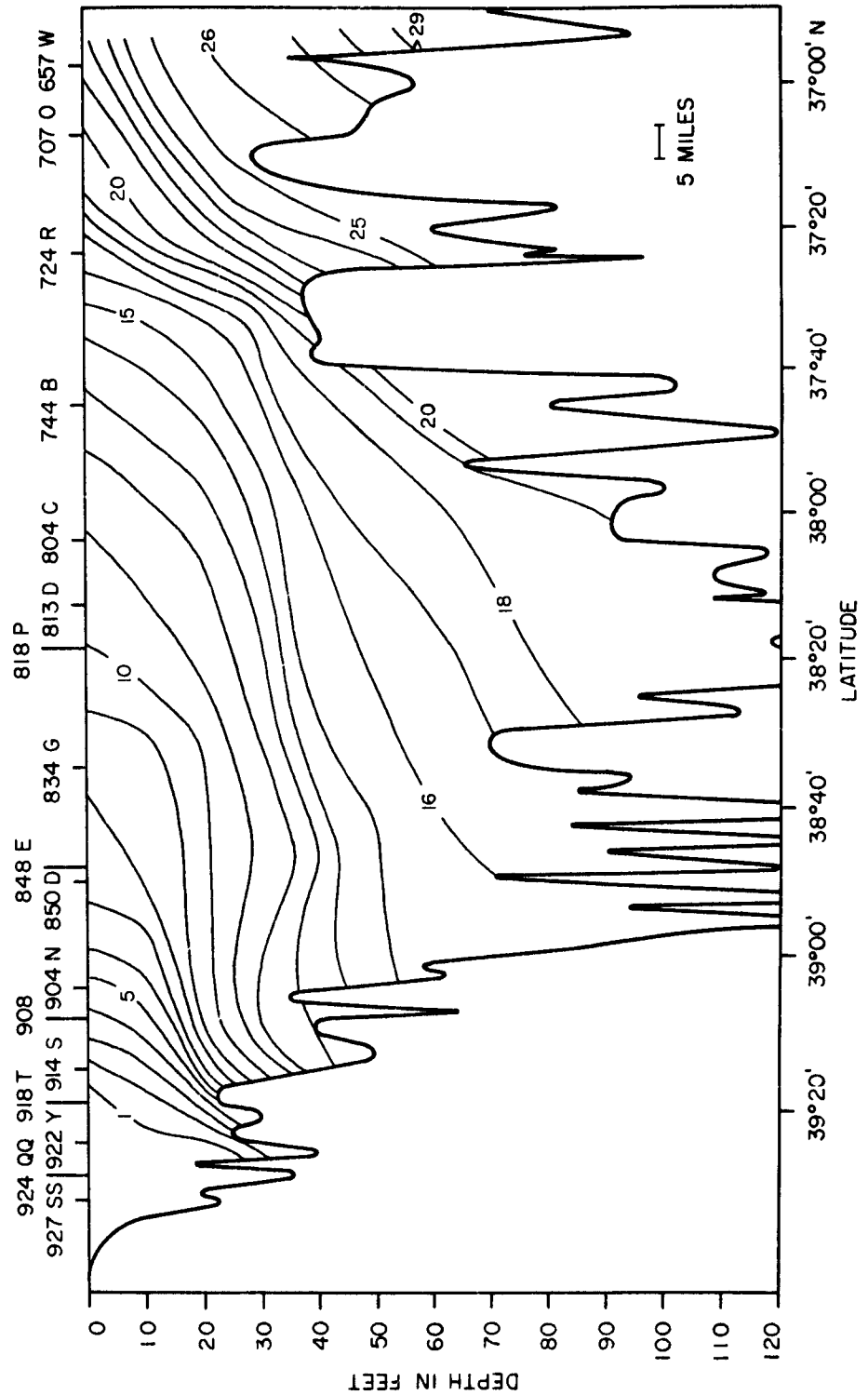
SPRING AVERAGE SECTION VI



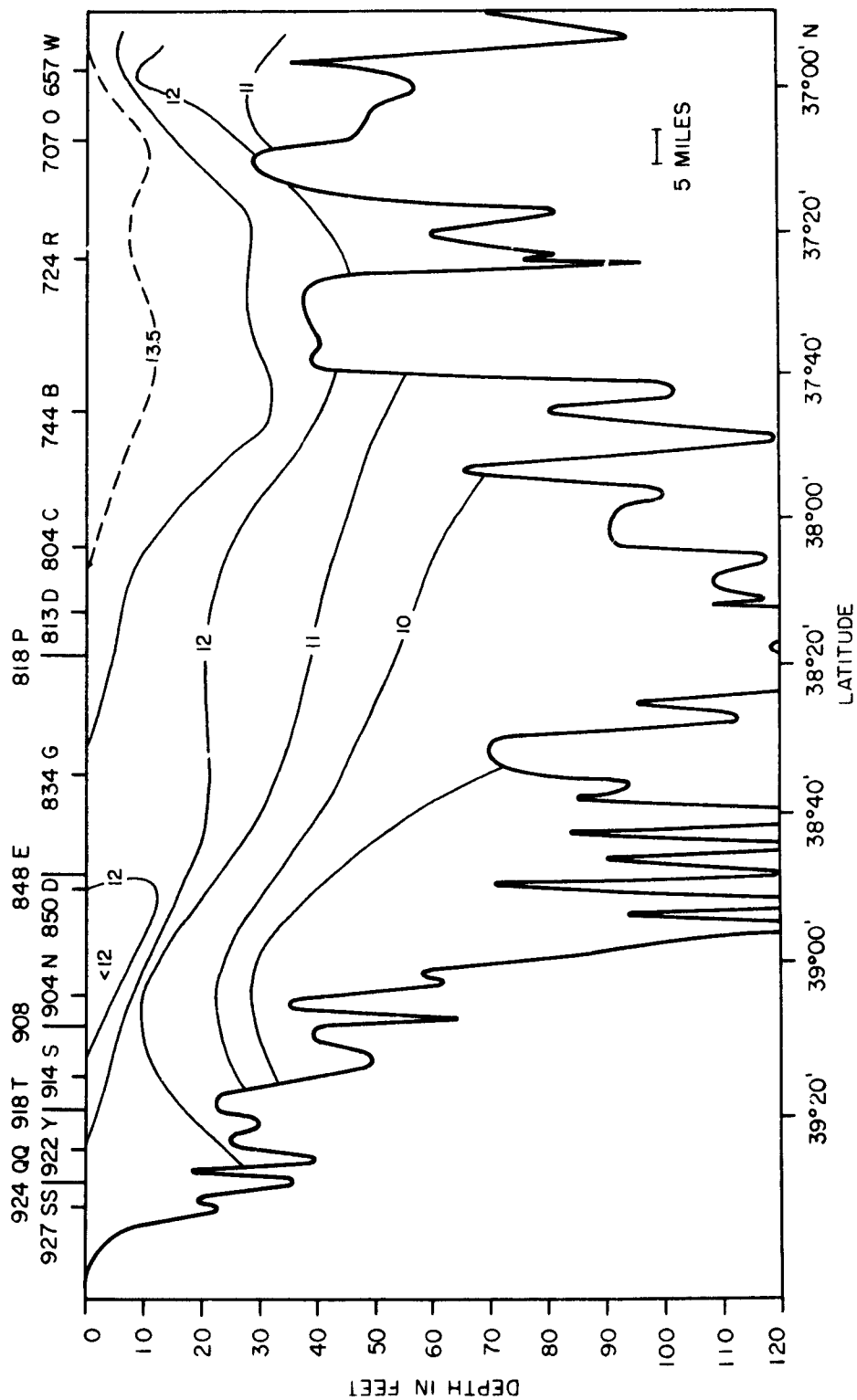
SPRING AVERAGE SECTION X

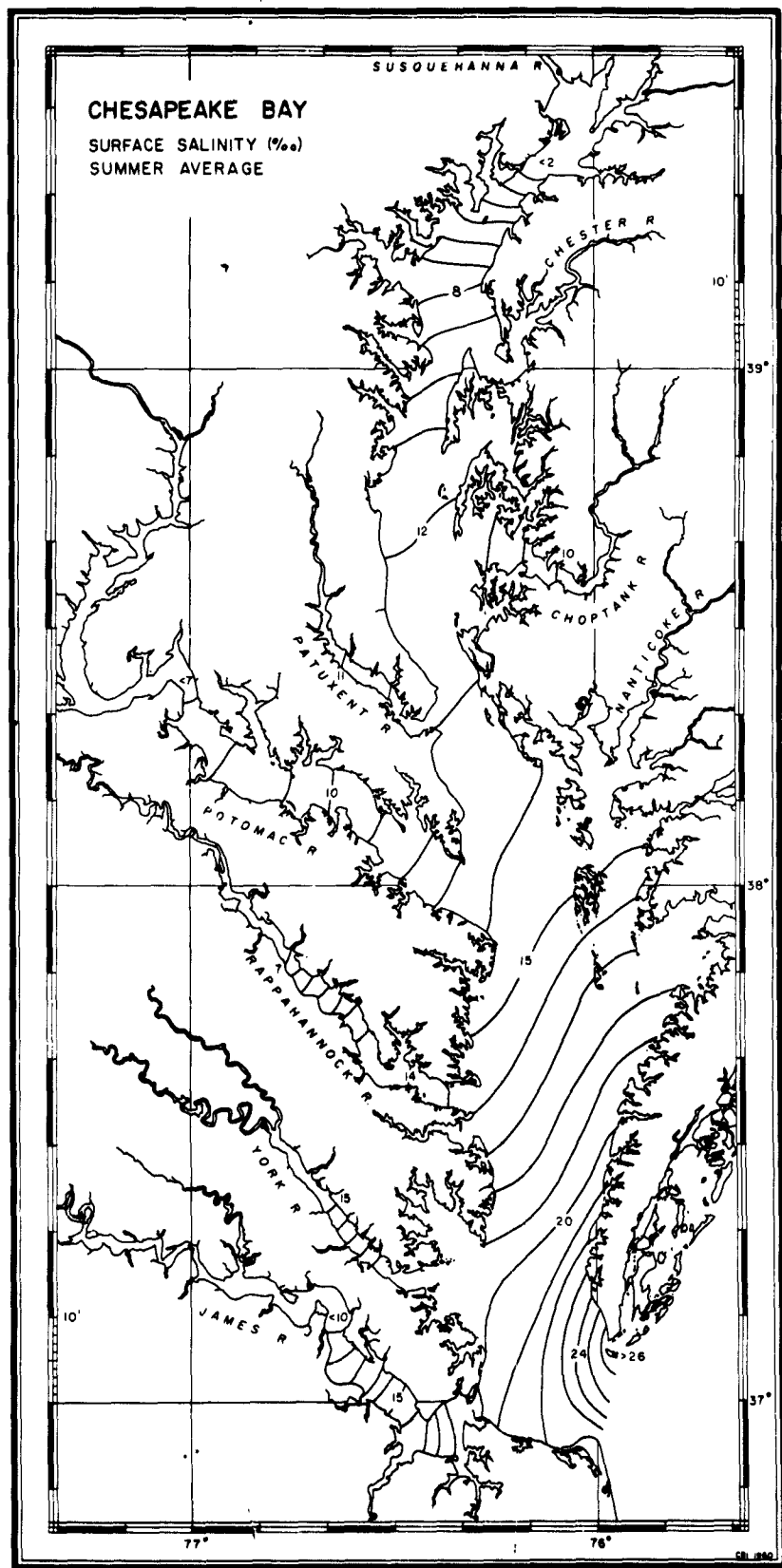


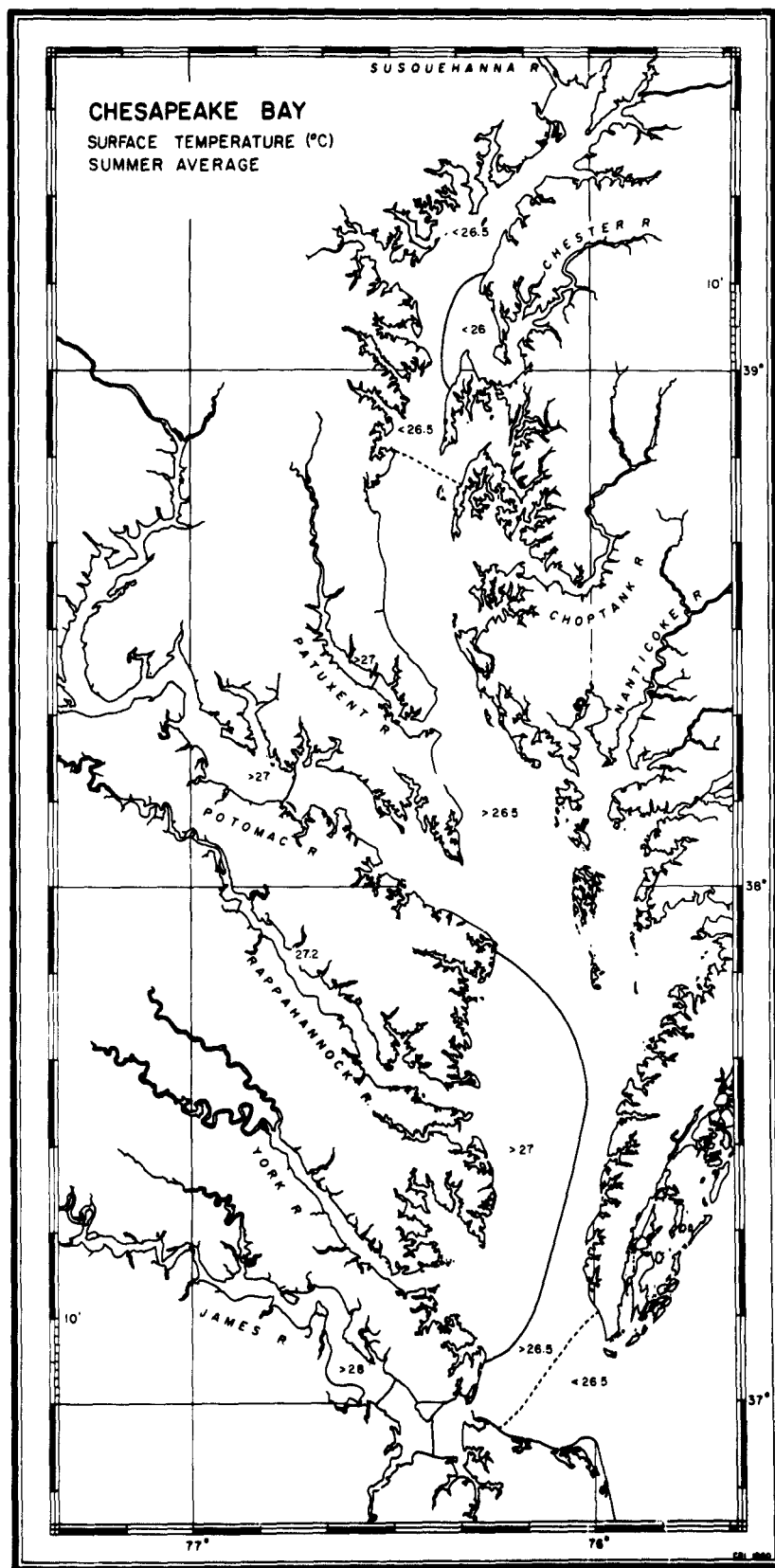
SPRING AVERAGE SECTION XIX SALINITY (‰)

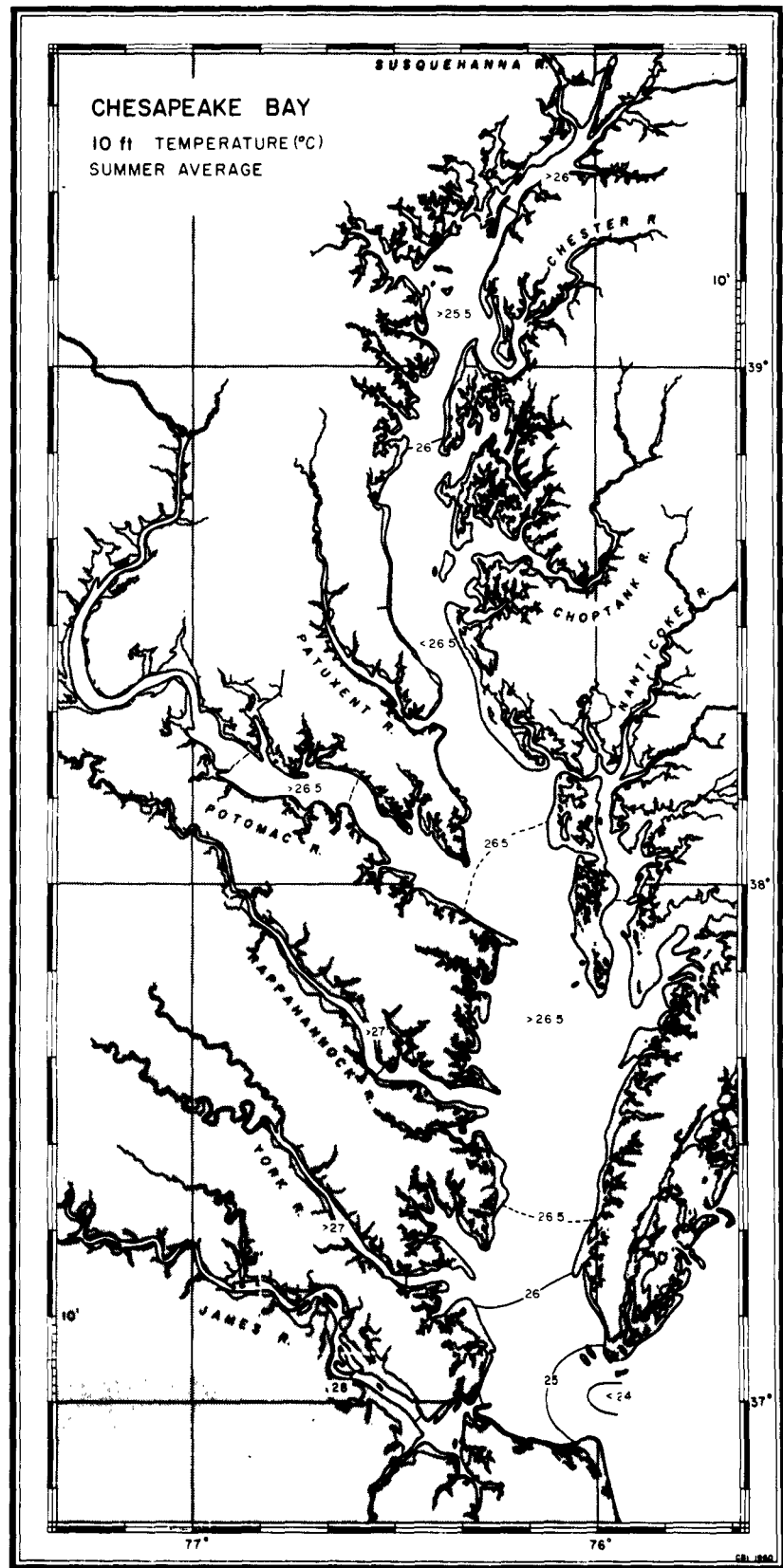


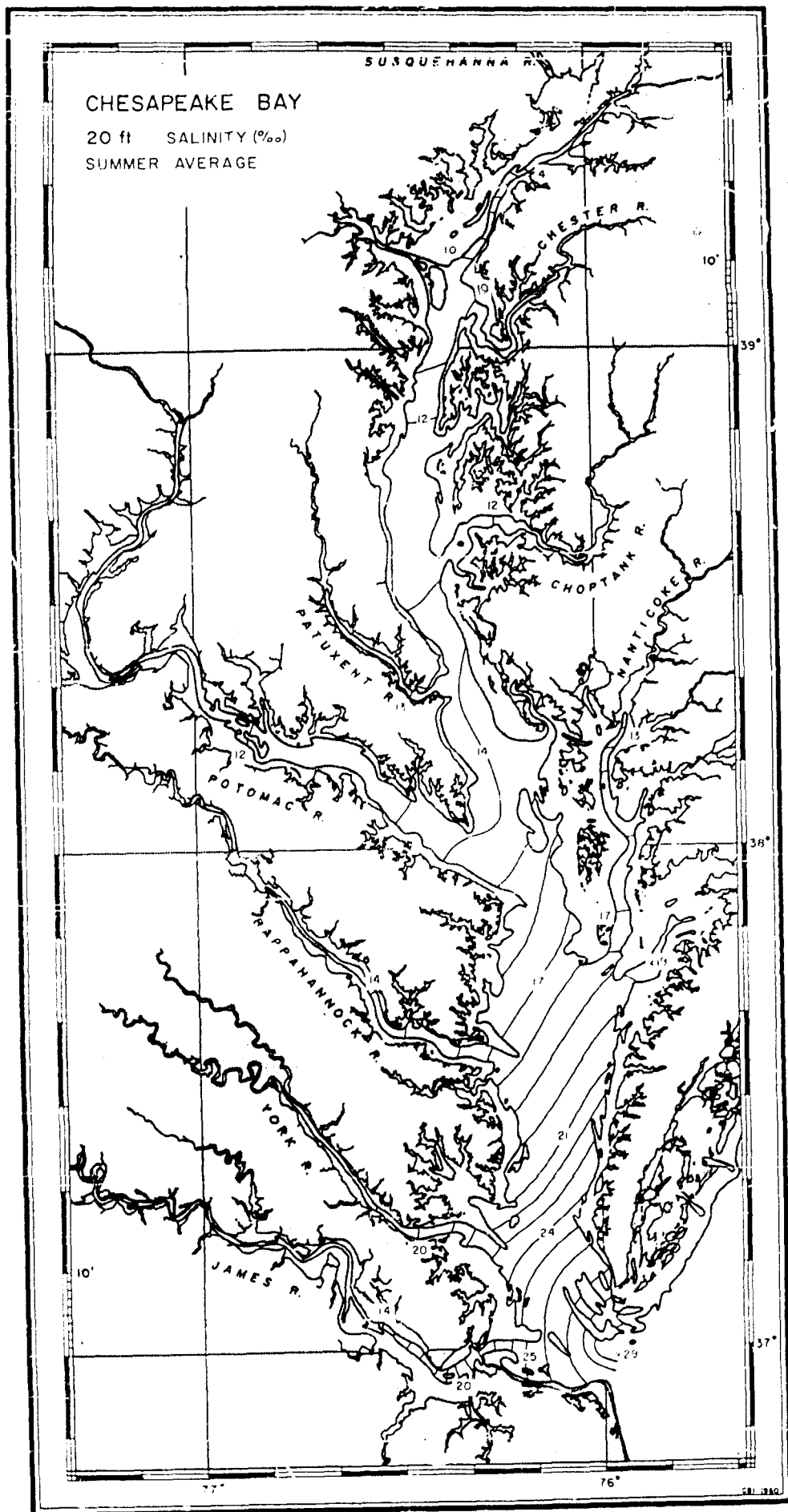
SPRING AVERAGE SECTION XIX TEMPERATURE (°C)





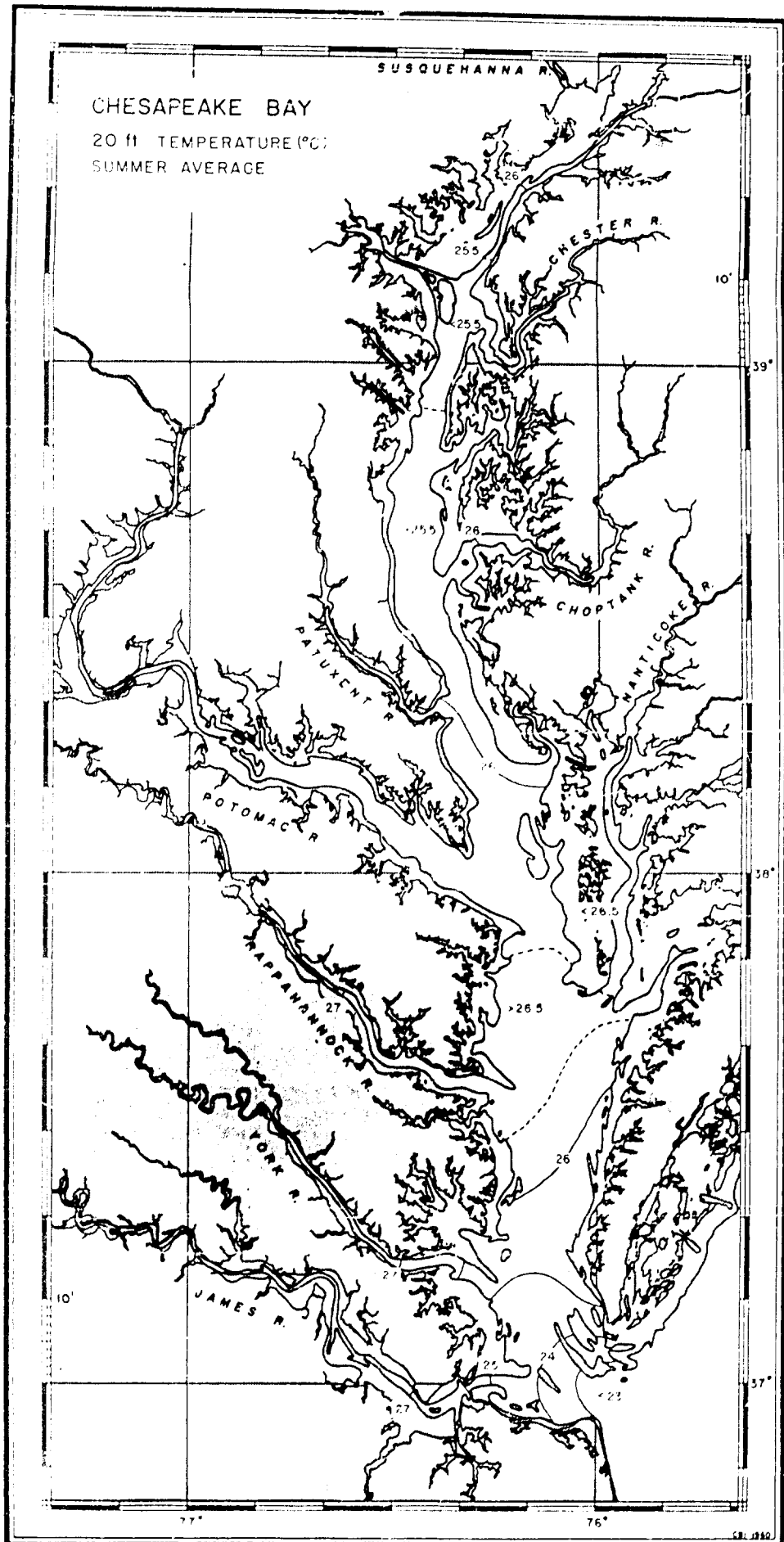


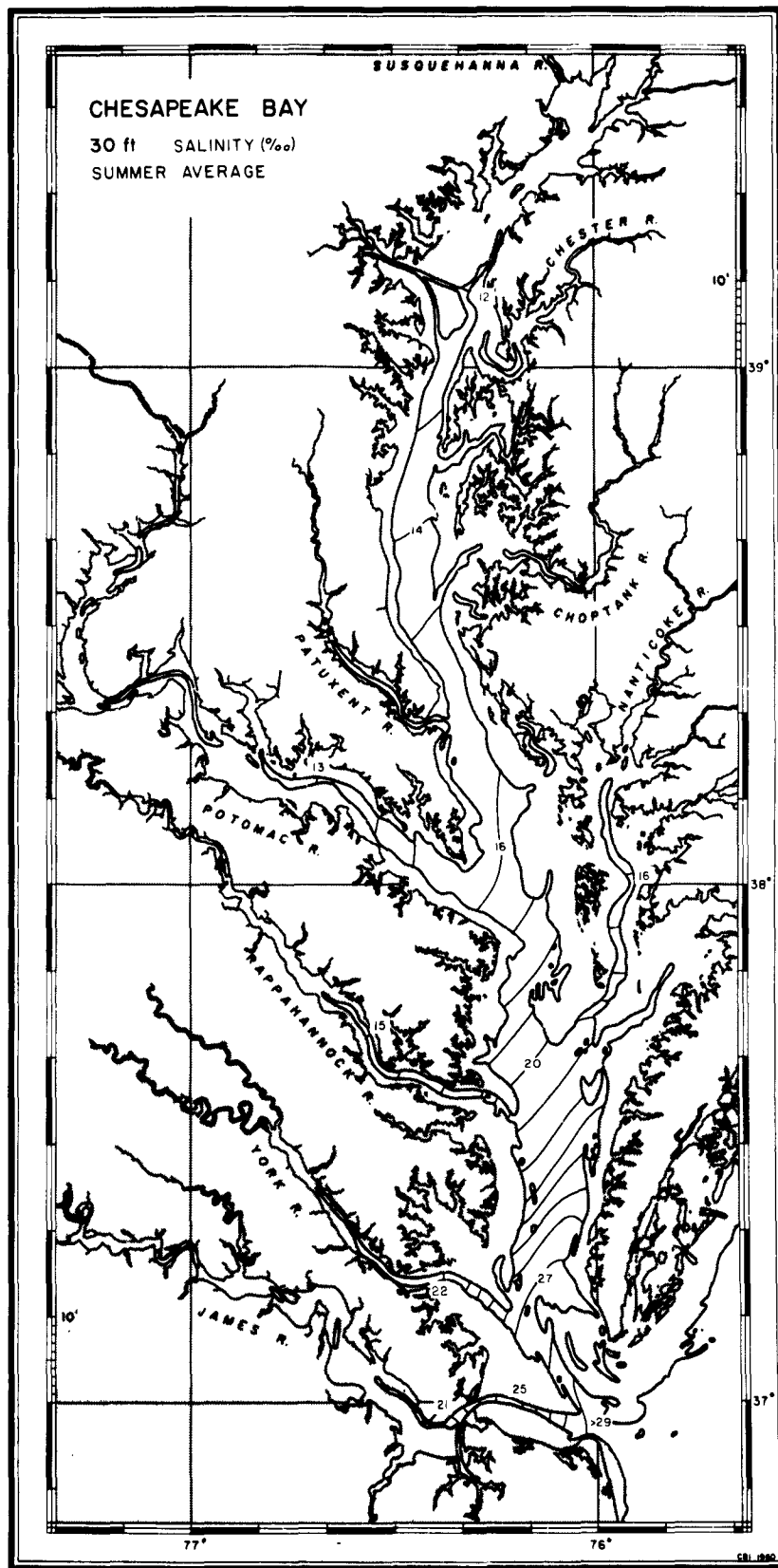


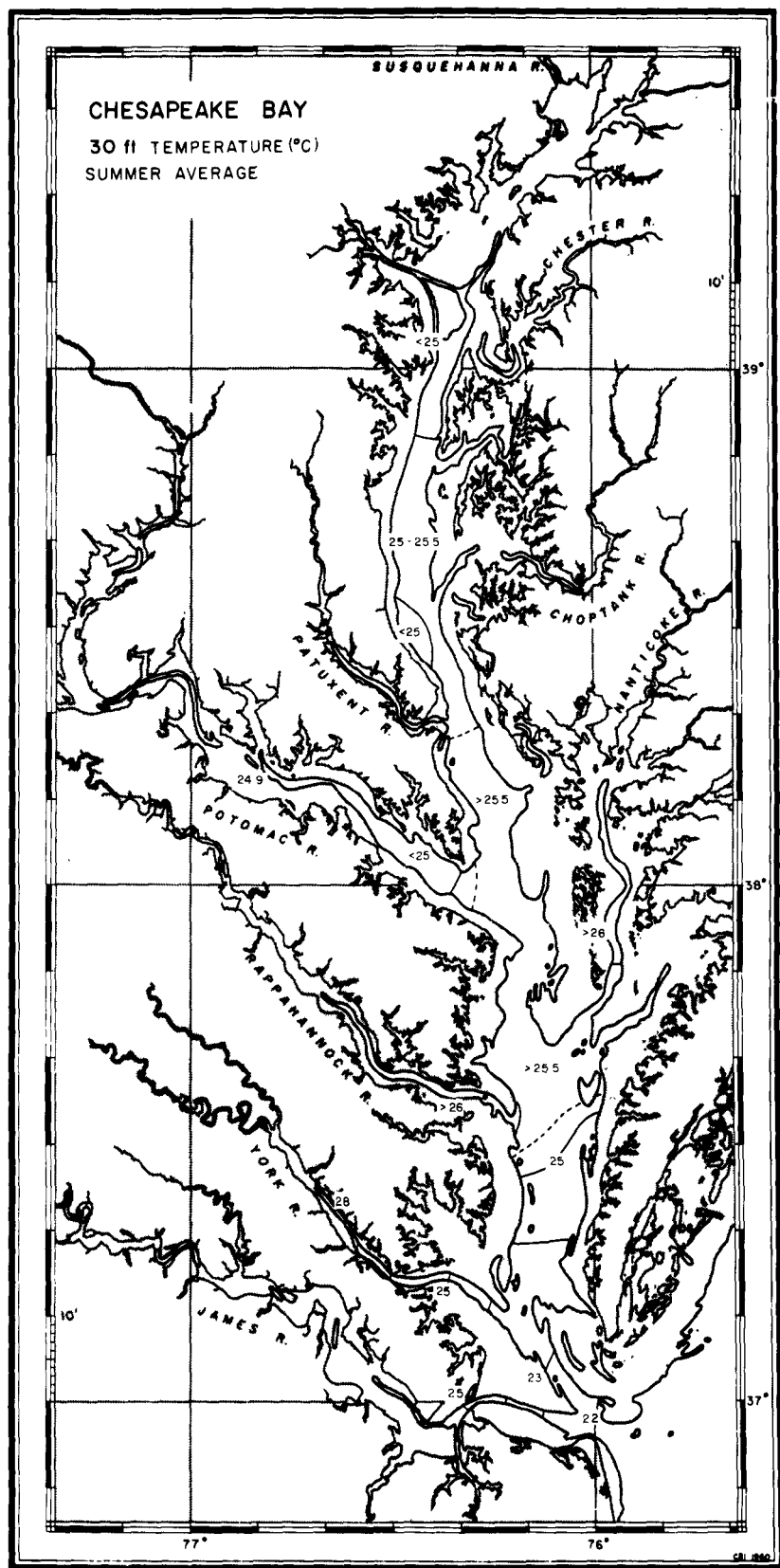


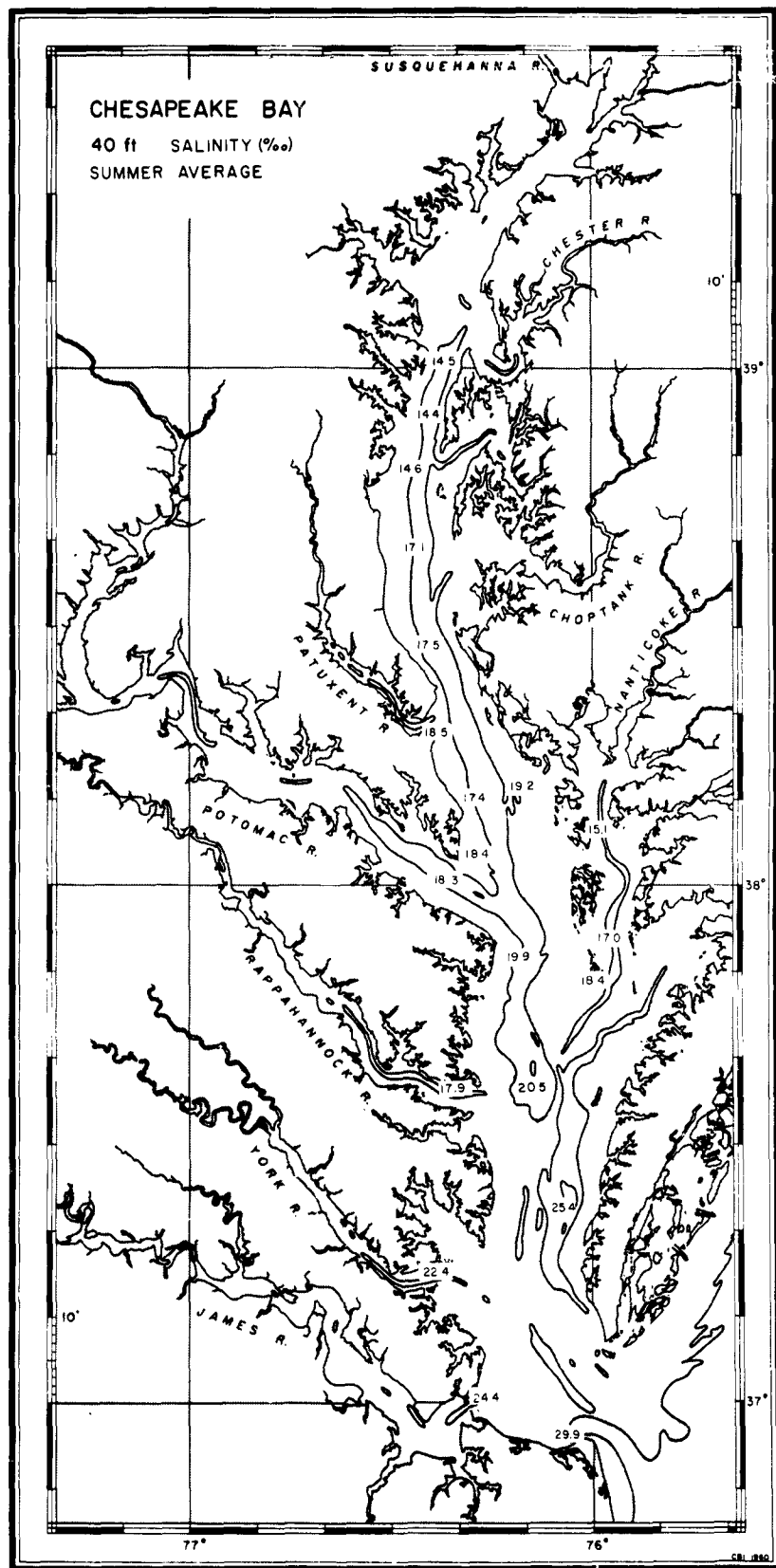
CHESAPEAKE BAY

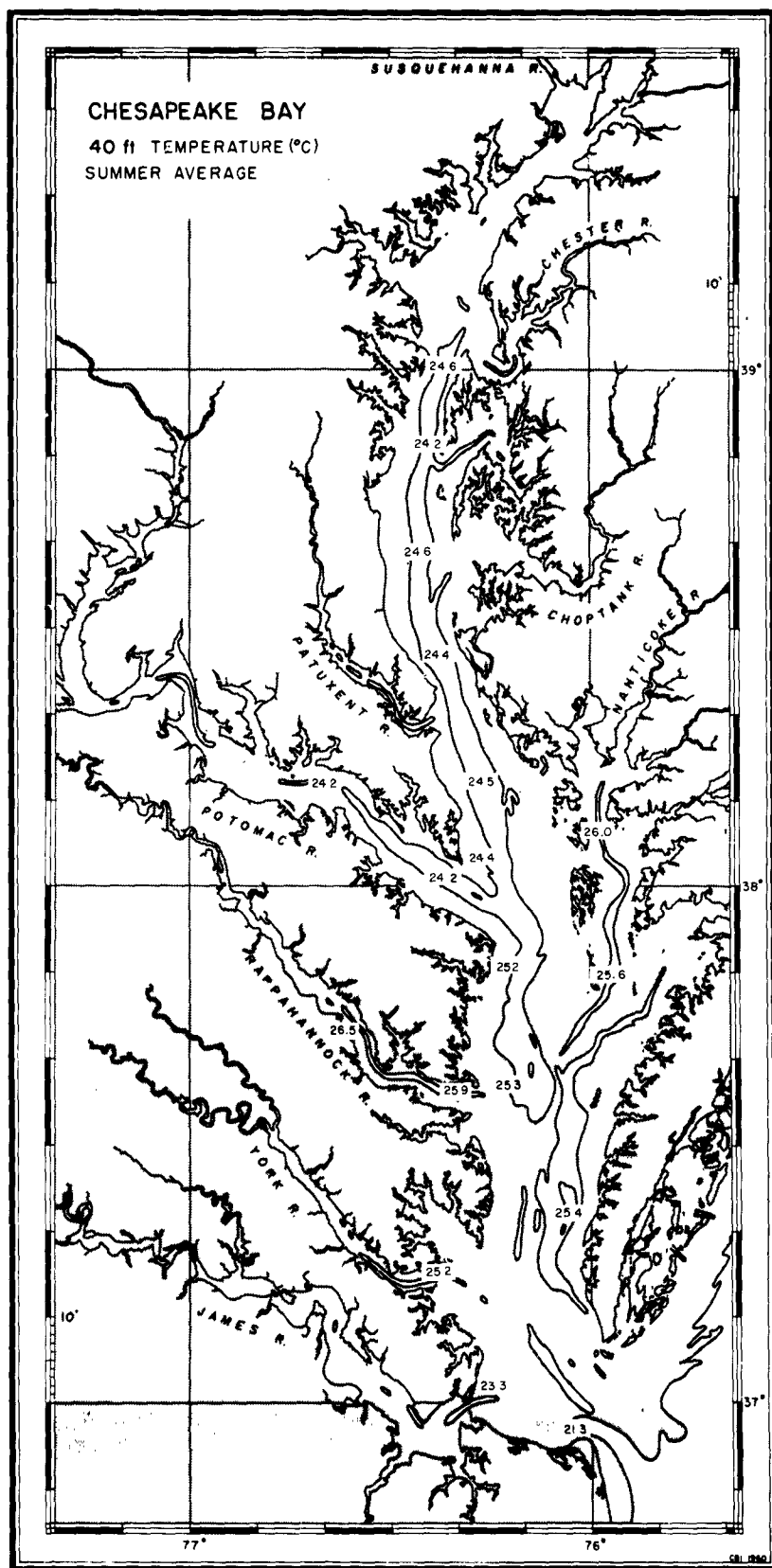
20 ft TEMPERATURE (°C)
SUMMER AVERAGE

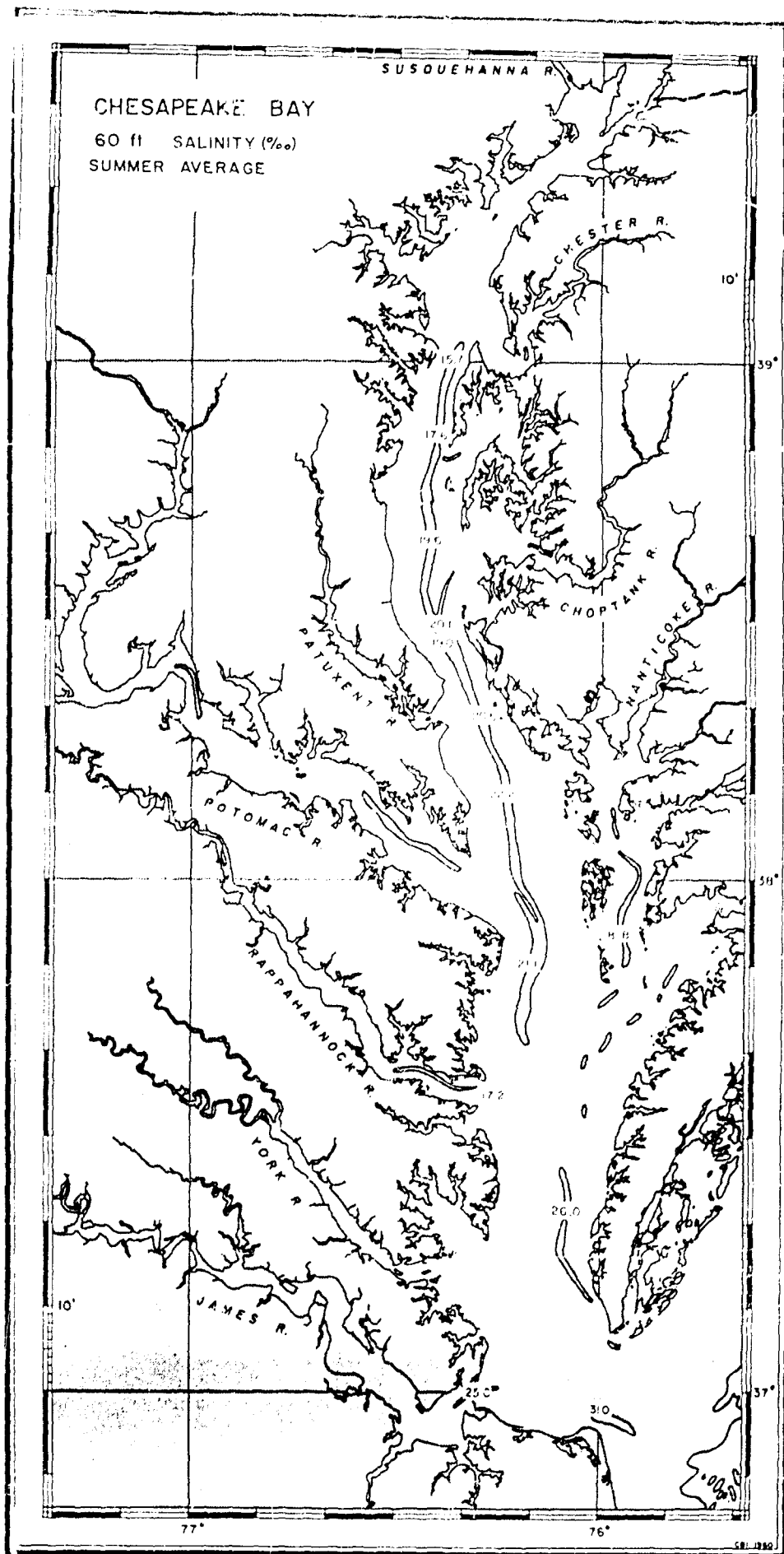


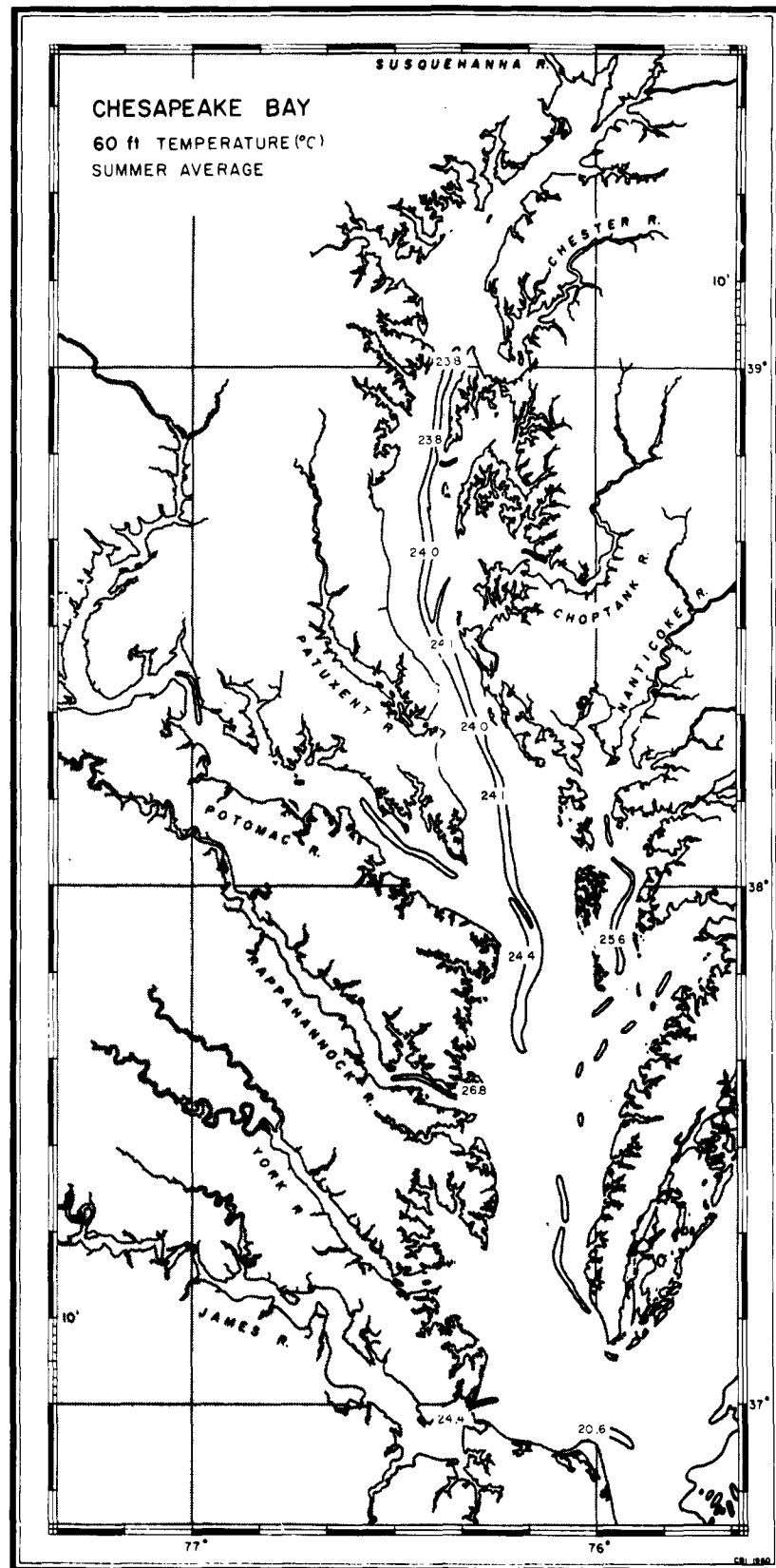




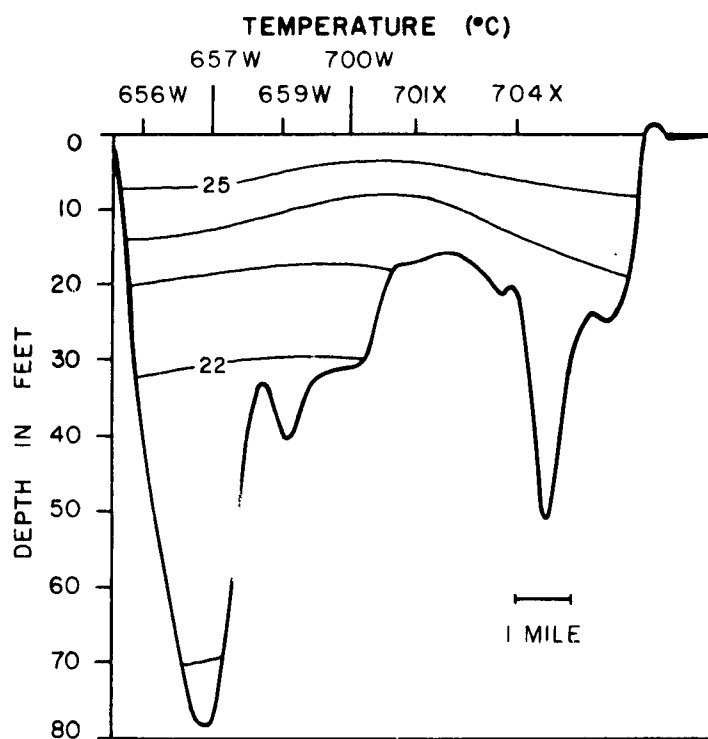
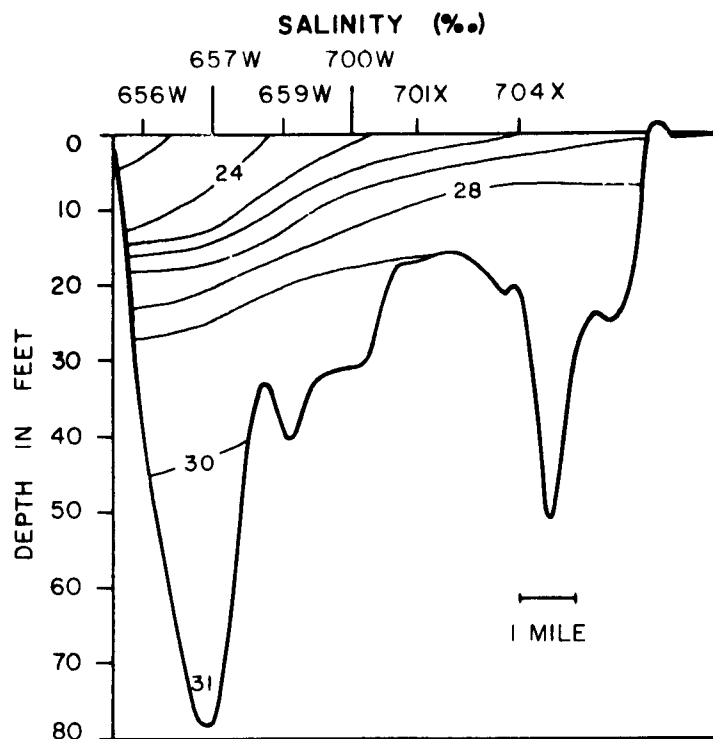




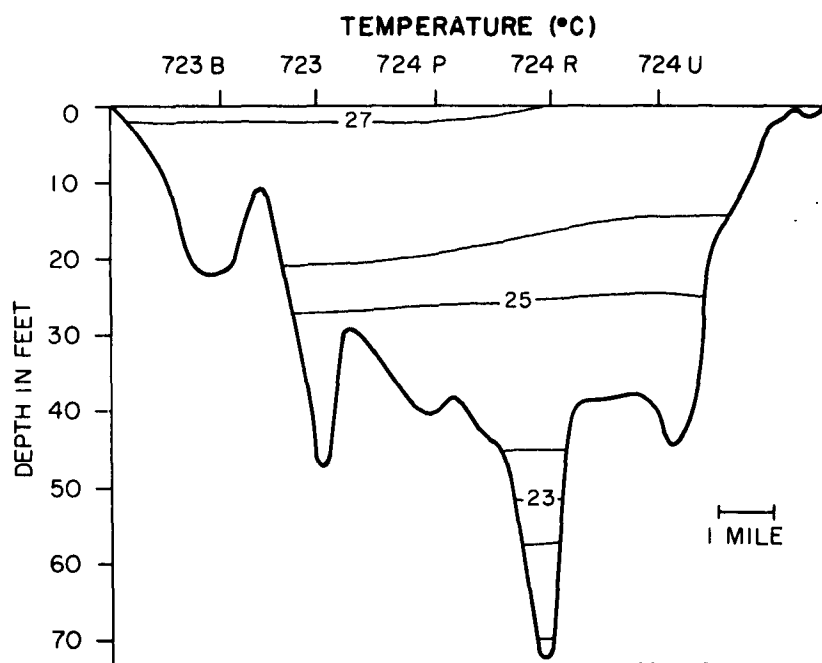
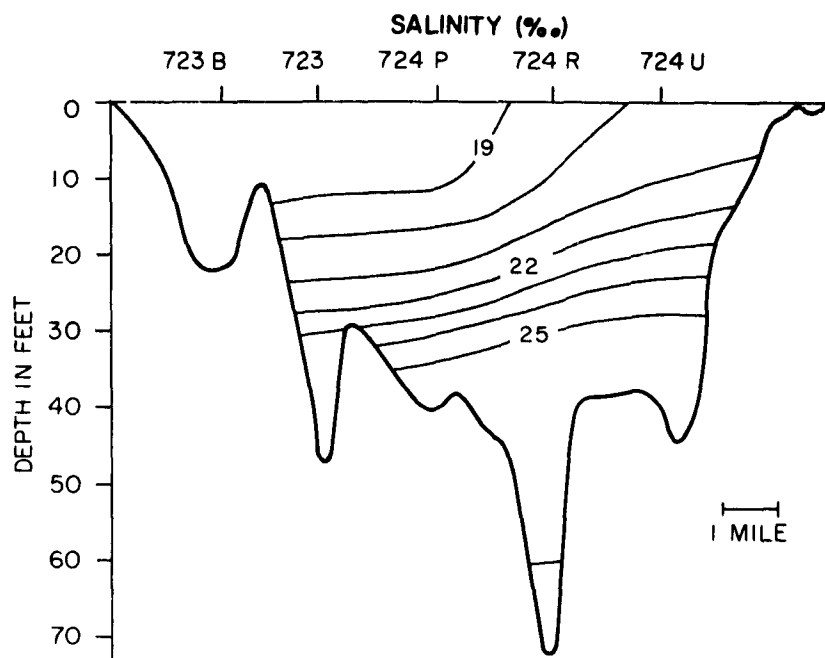




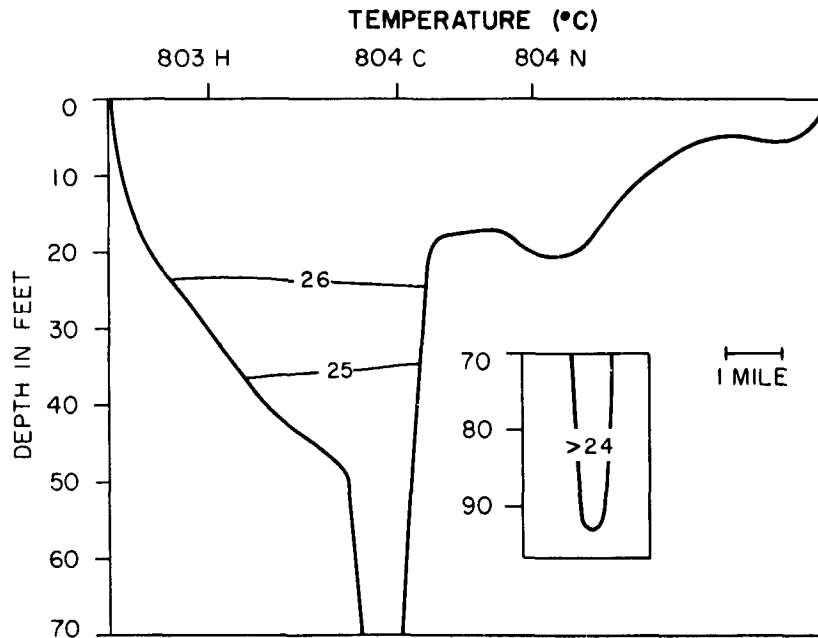
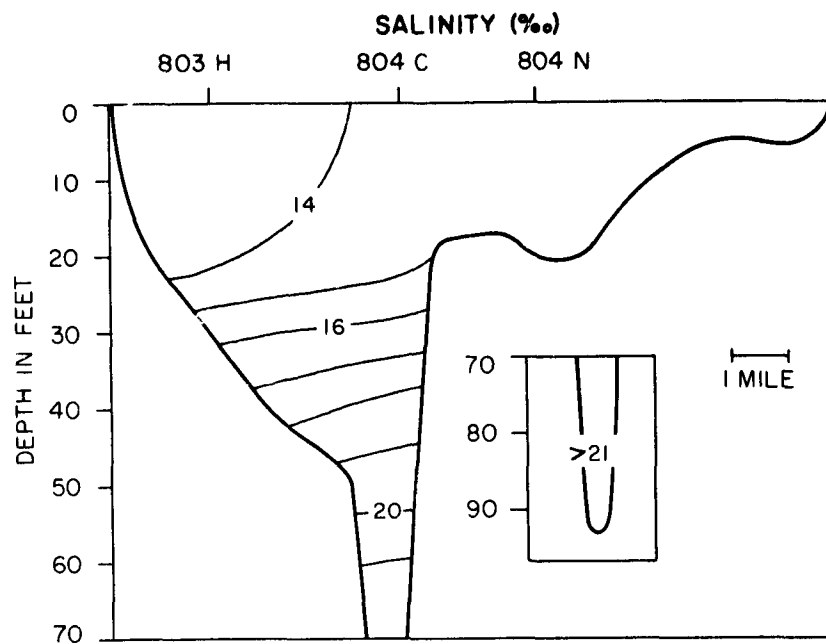
SUMMER AVERAGE SECTION II



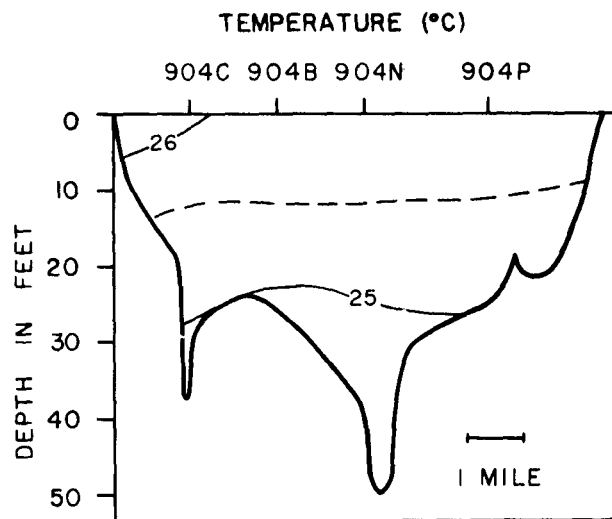
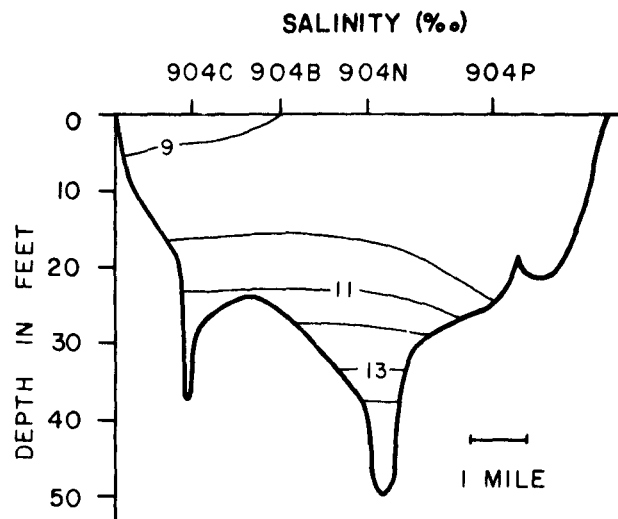
SUMMER AVERAGE SECTION IV



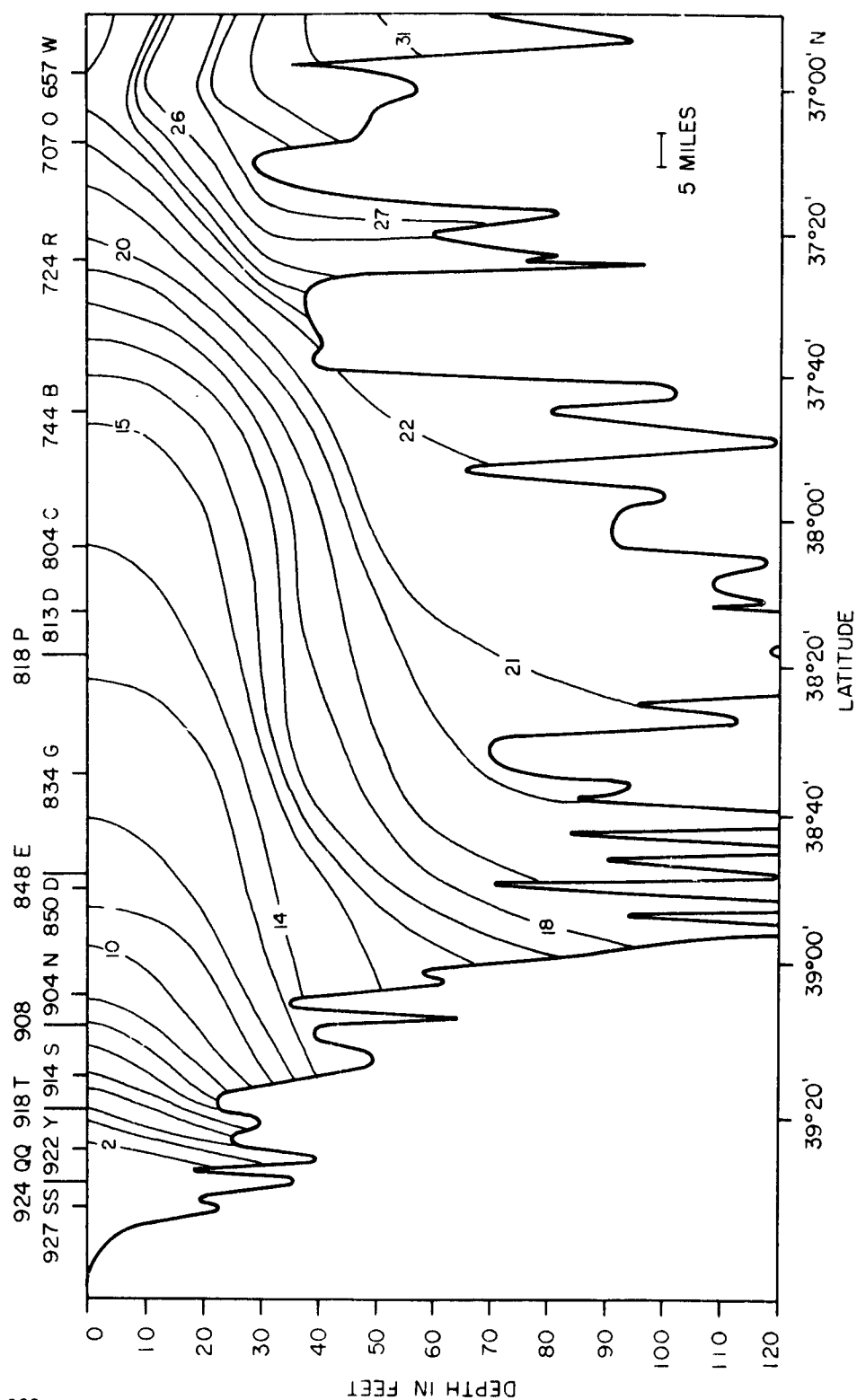
SUMMER AVERAGE SECTION VI



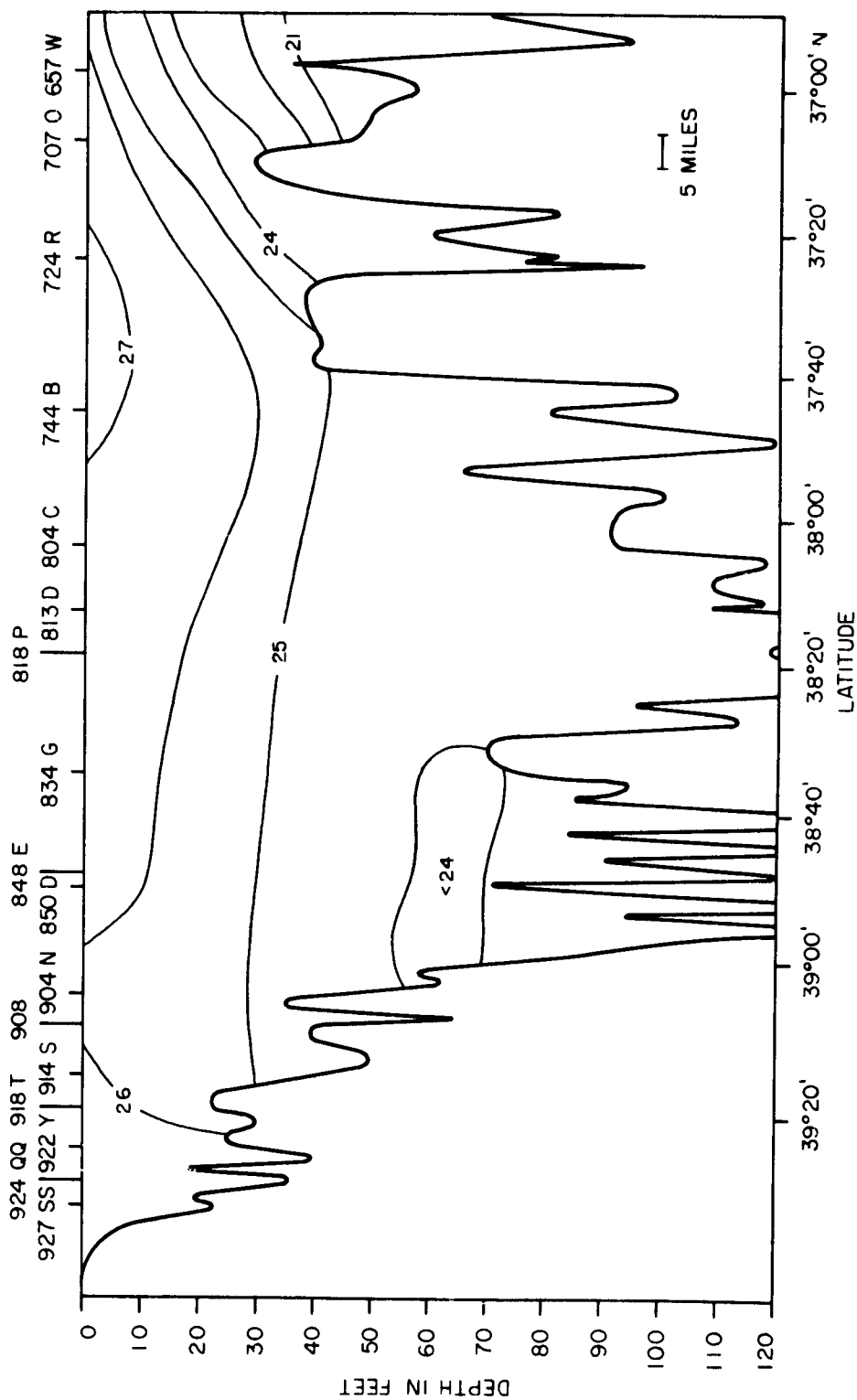
SUMMER AVERAGE SECTION X

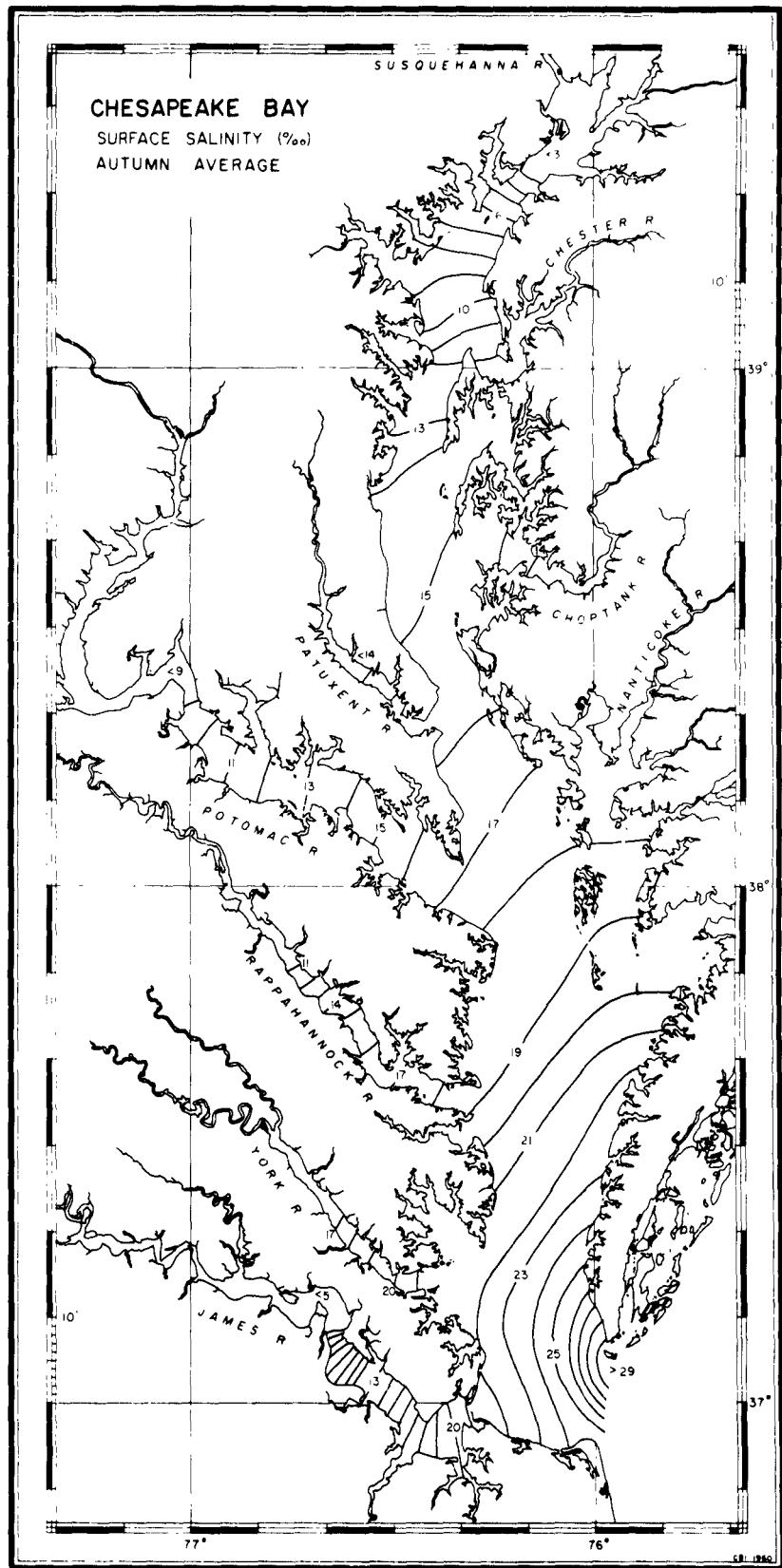


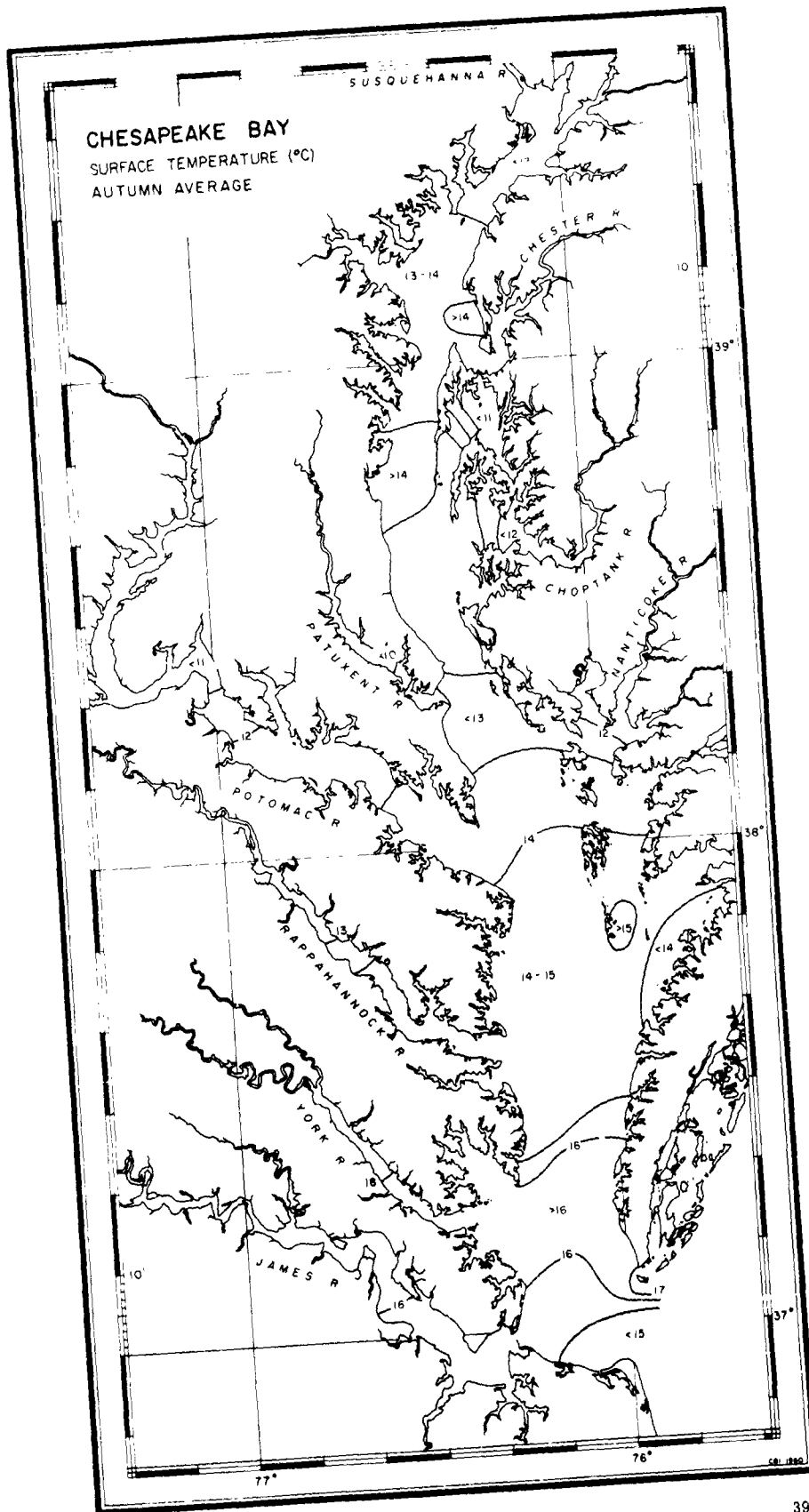
SUMMER AVERAGE SECTION XIX SALINITY (‰)

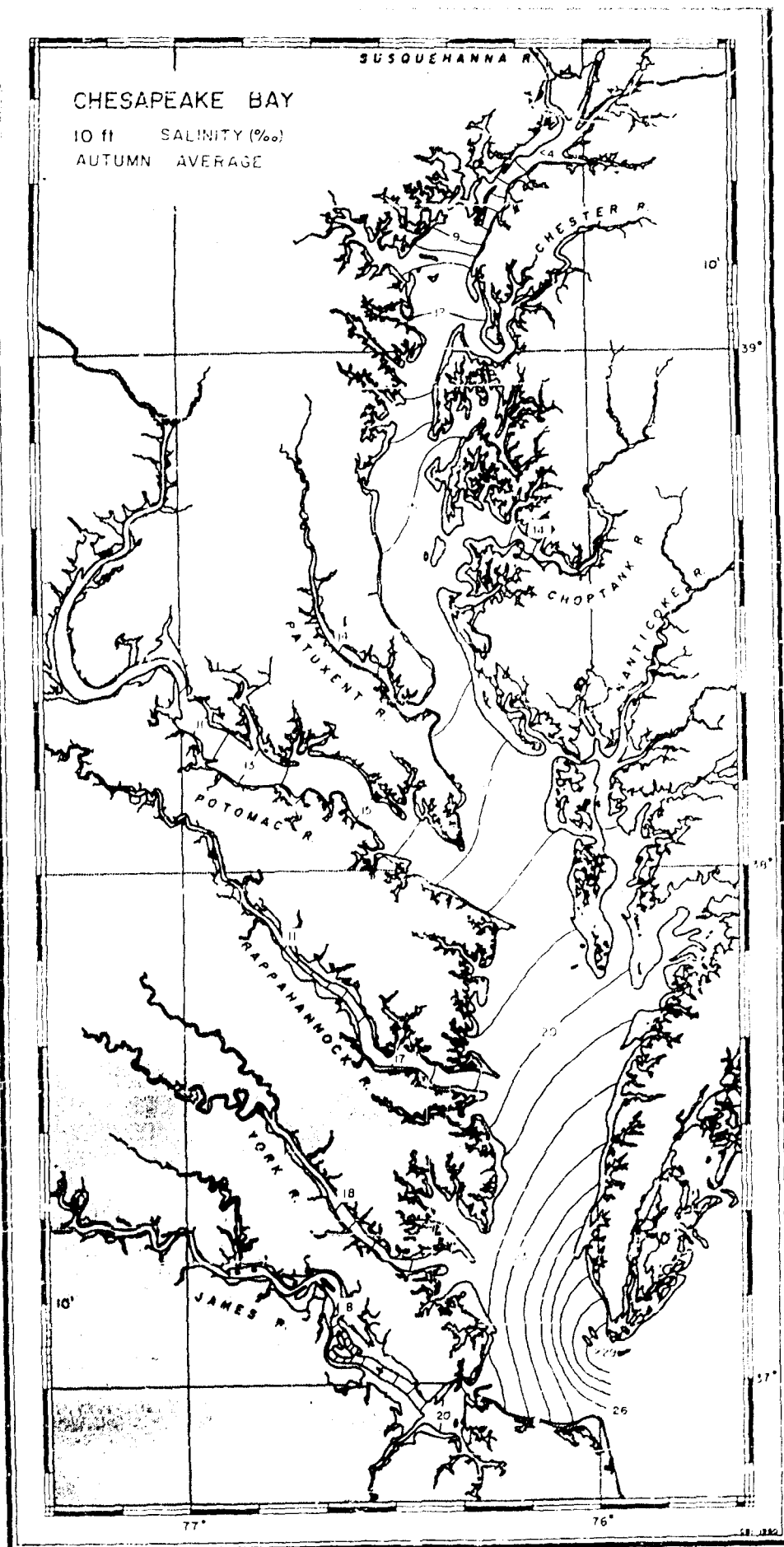


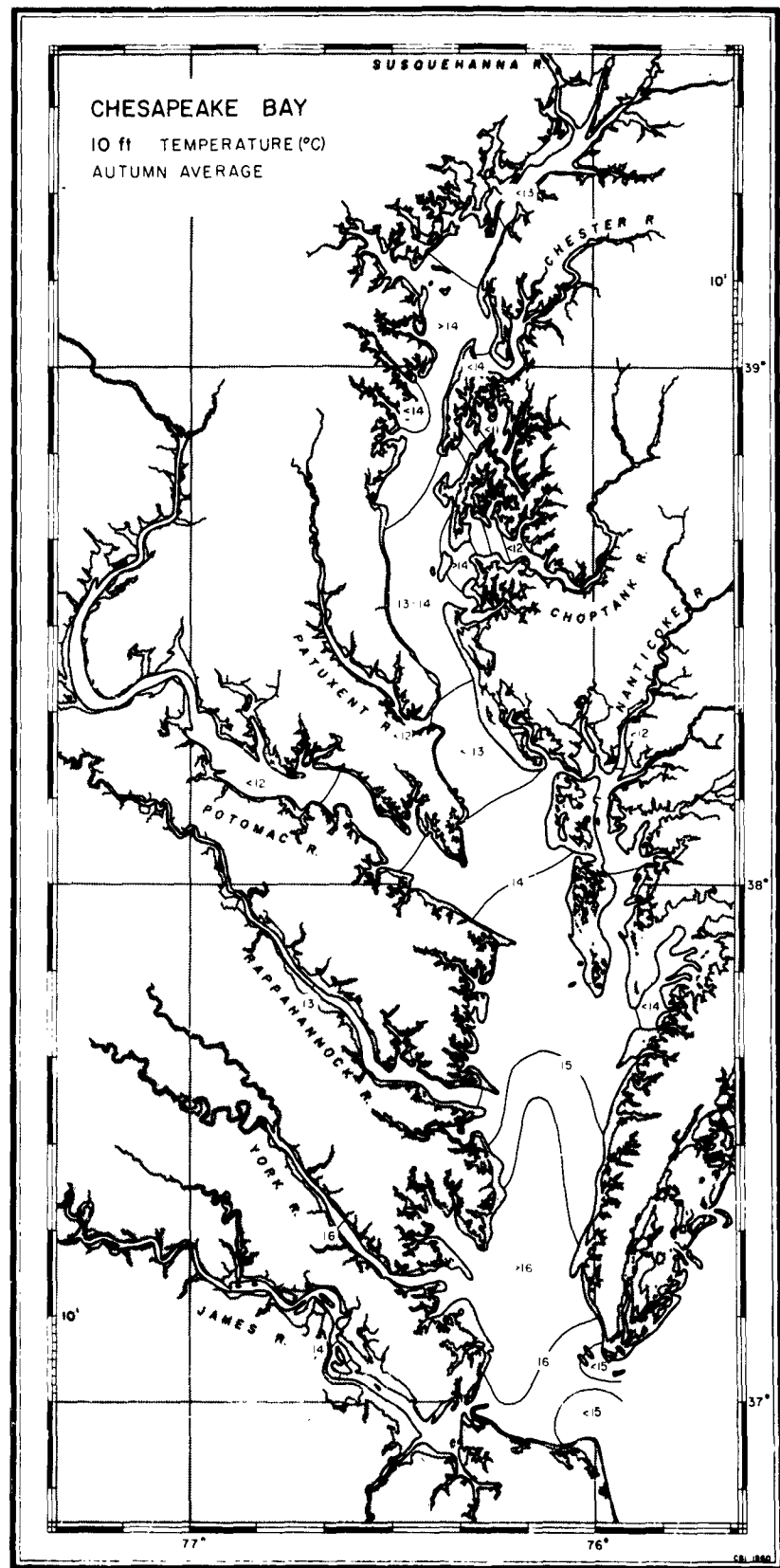
SUMMER AVERAGE SECTION XIX TEMPERATURE (°C)

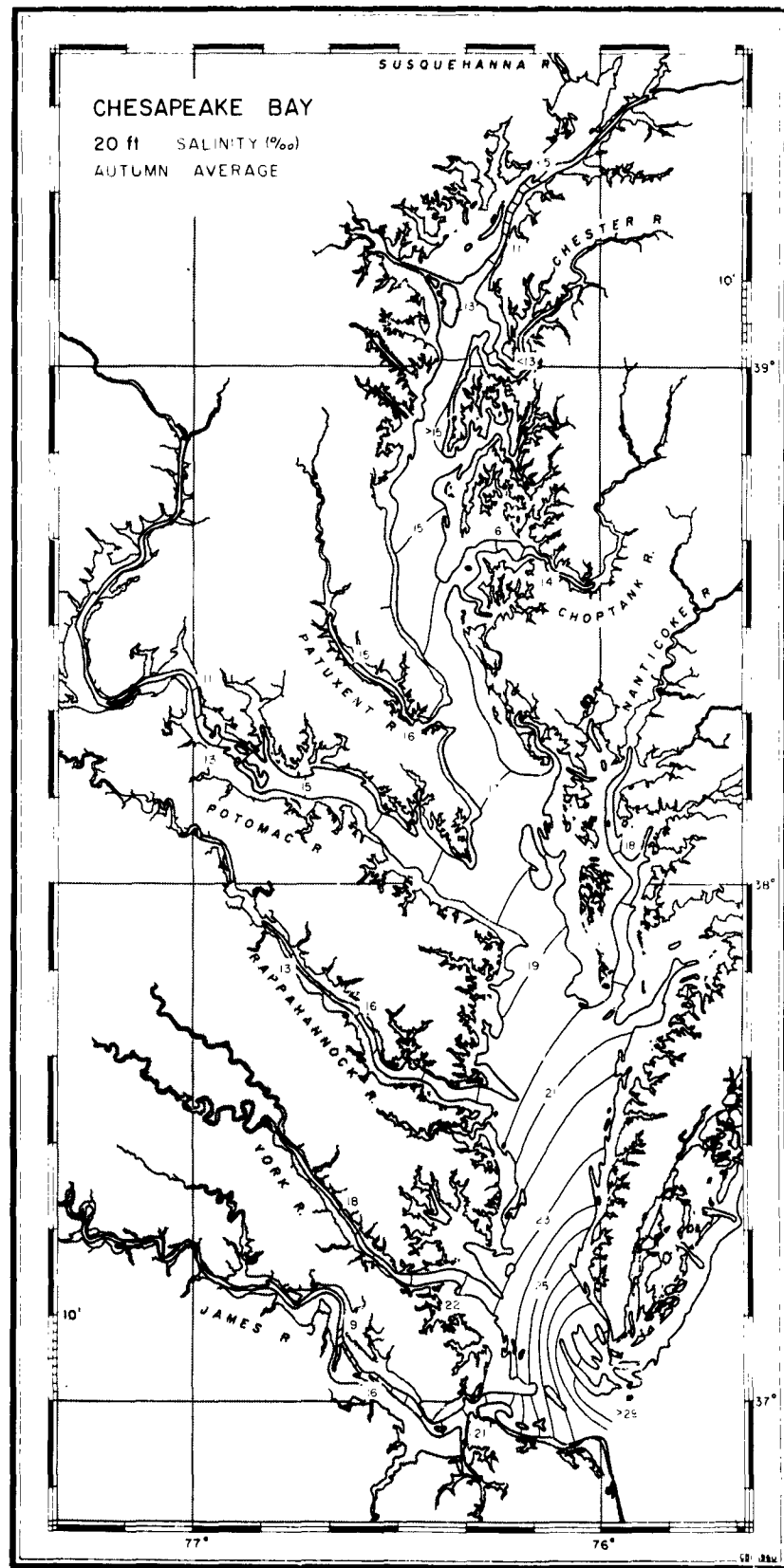


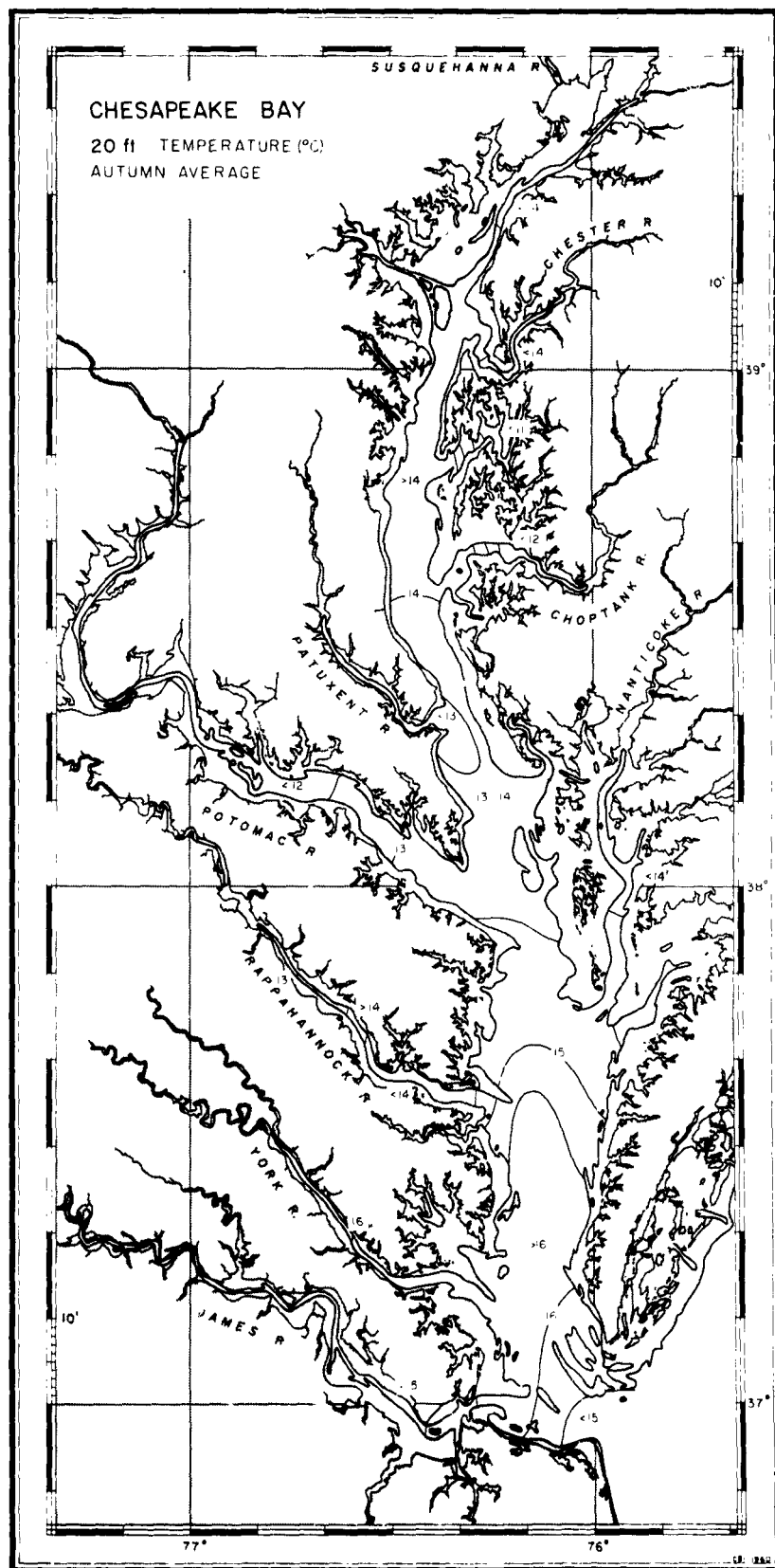


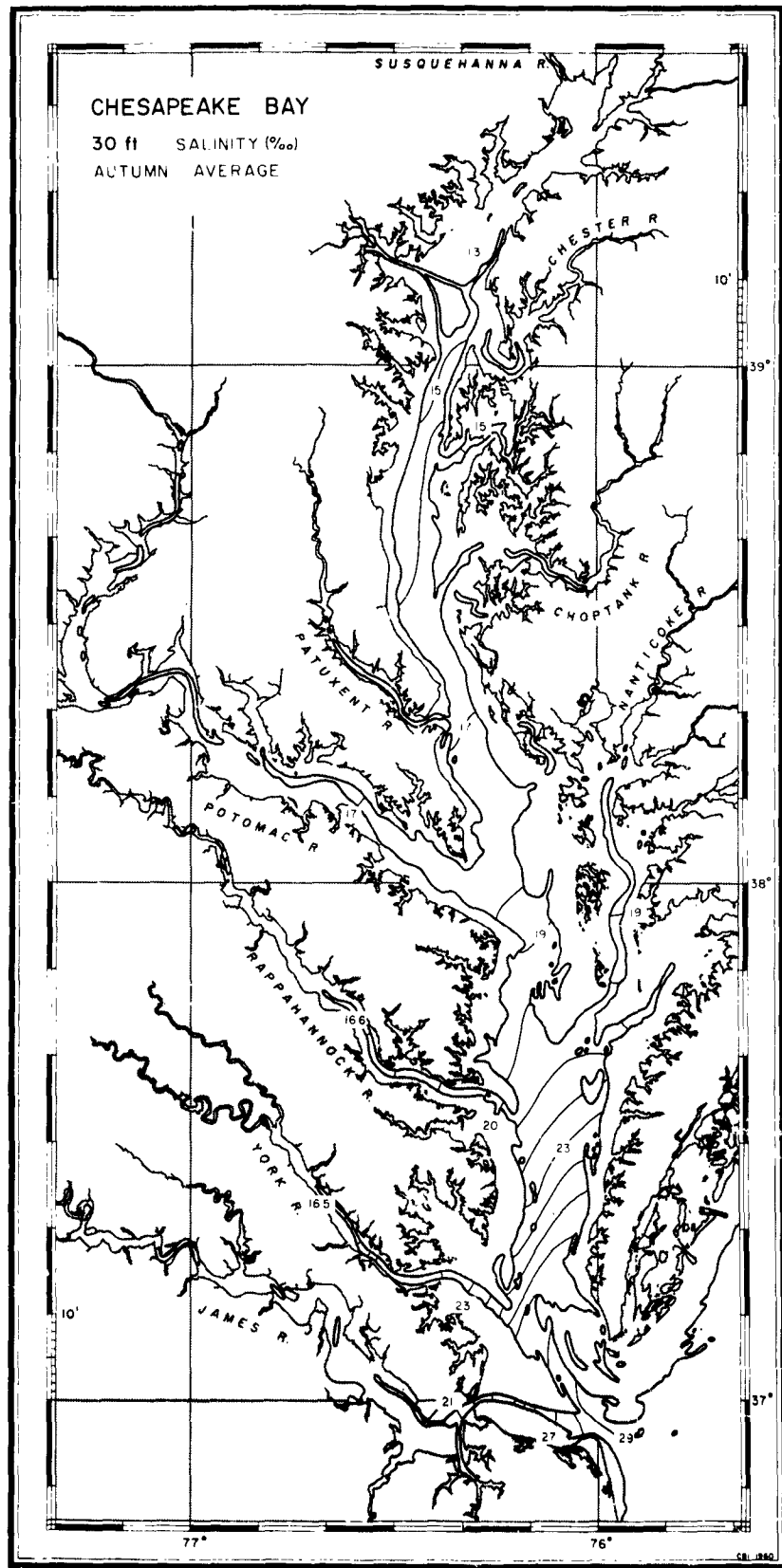


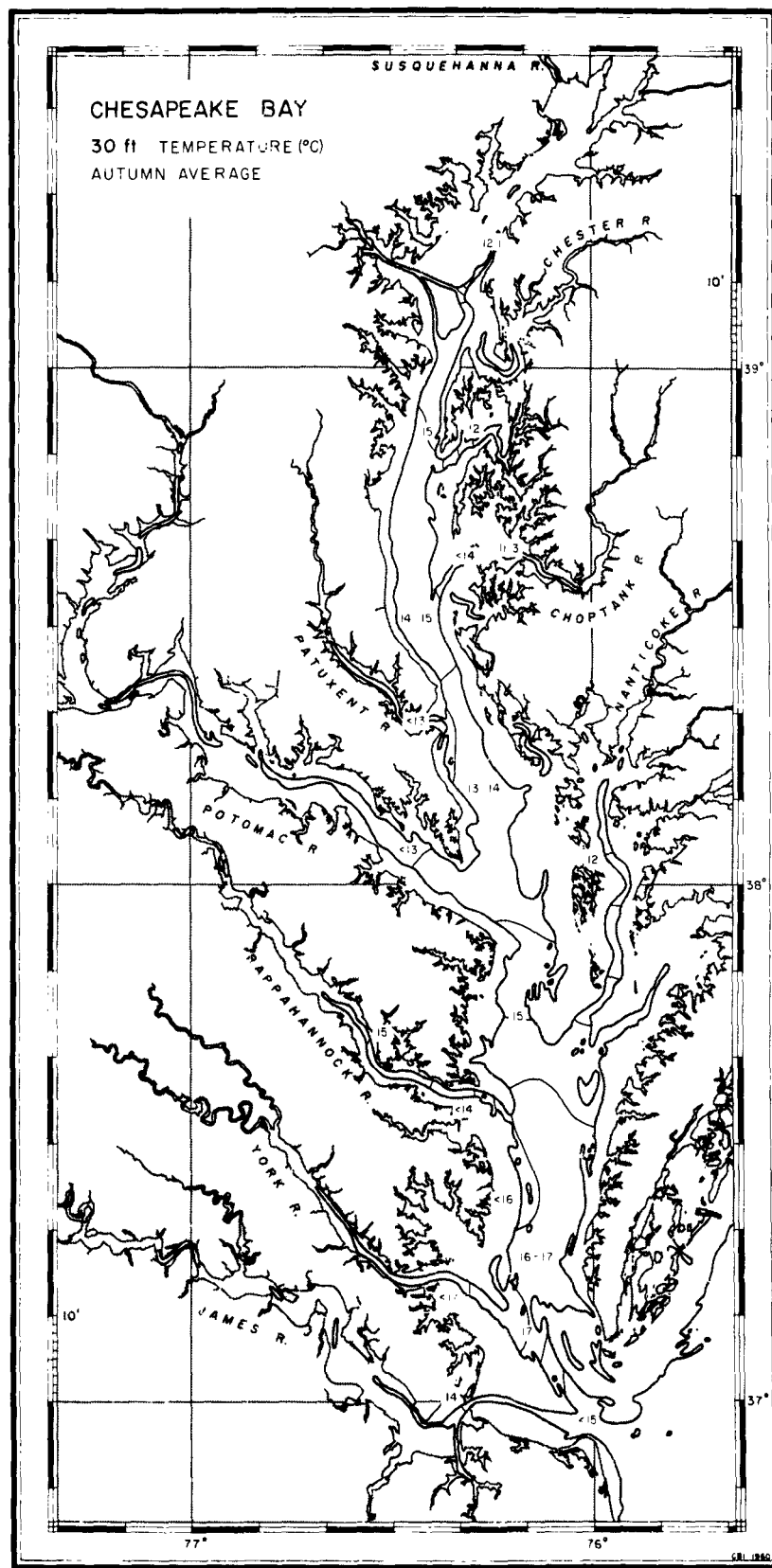


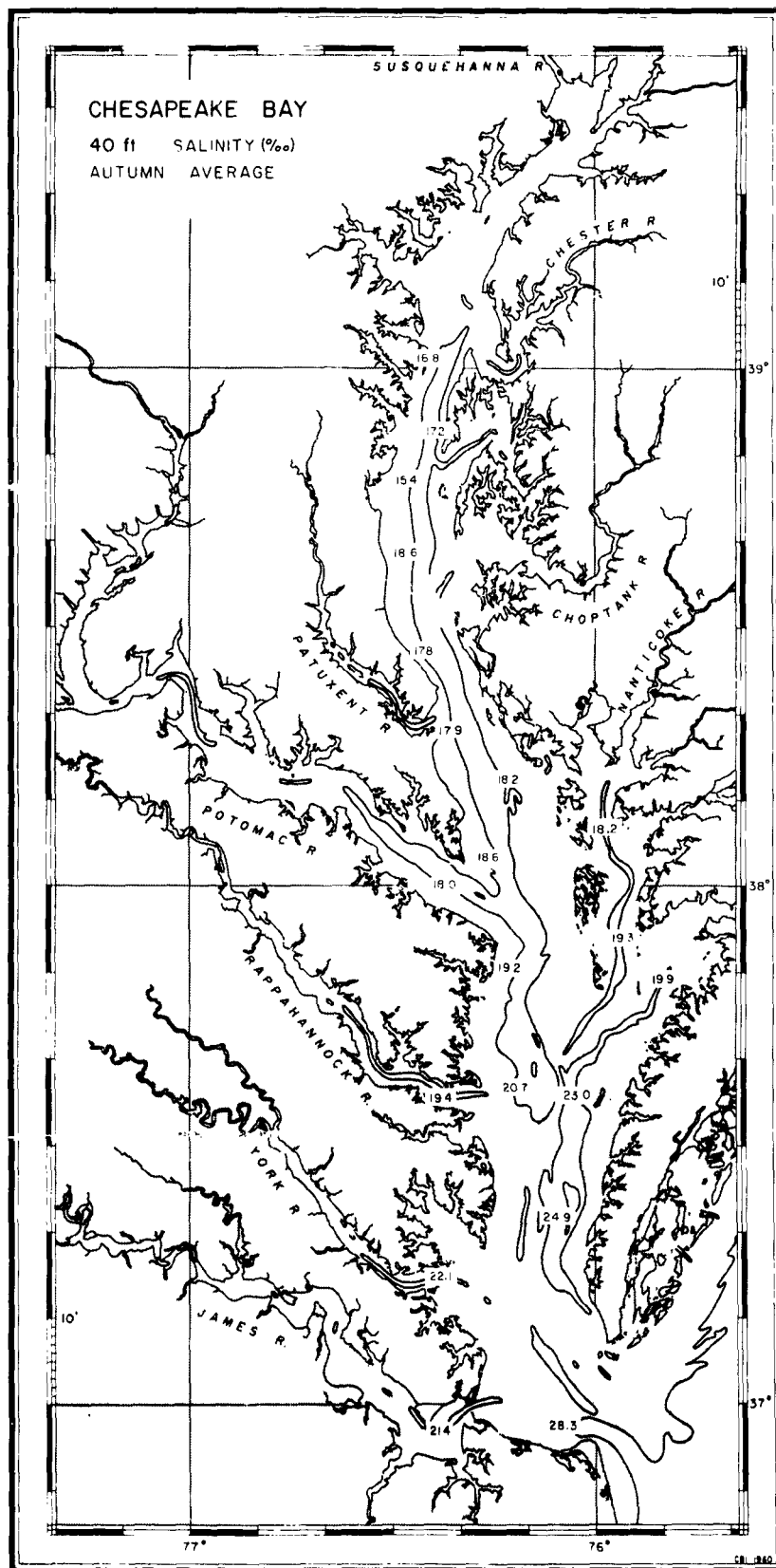


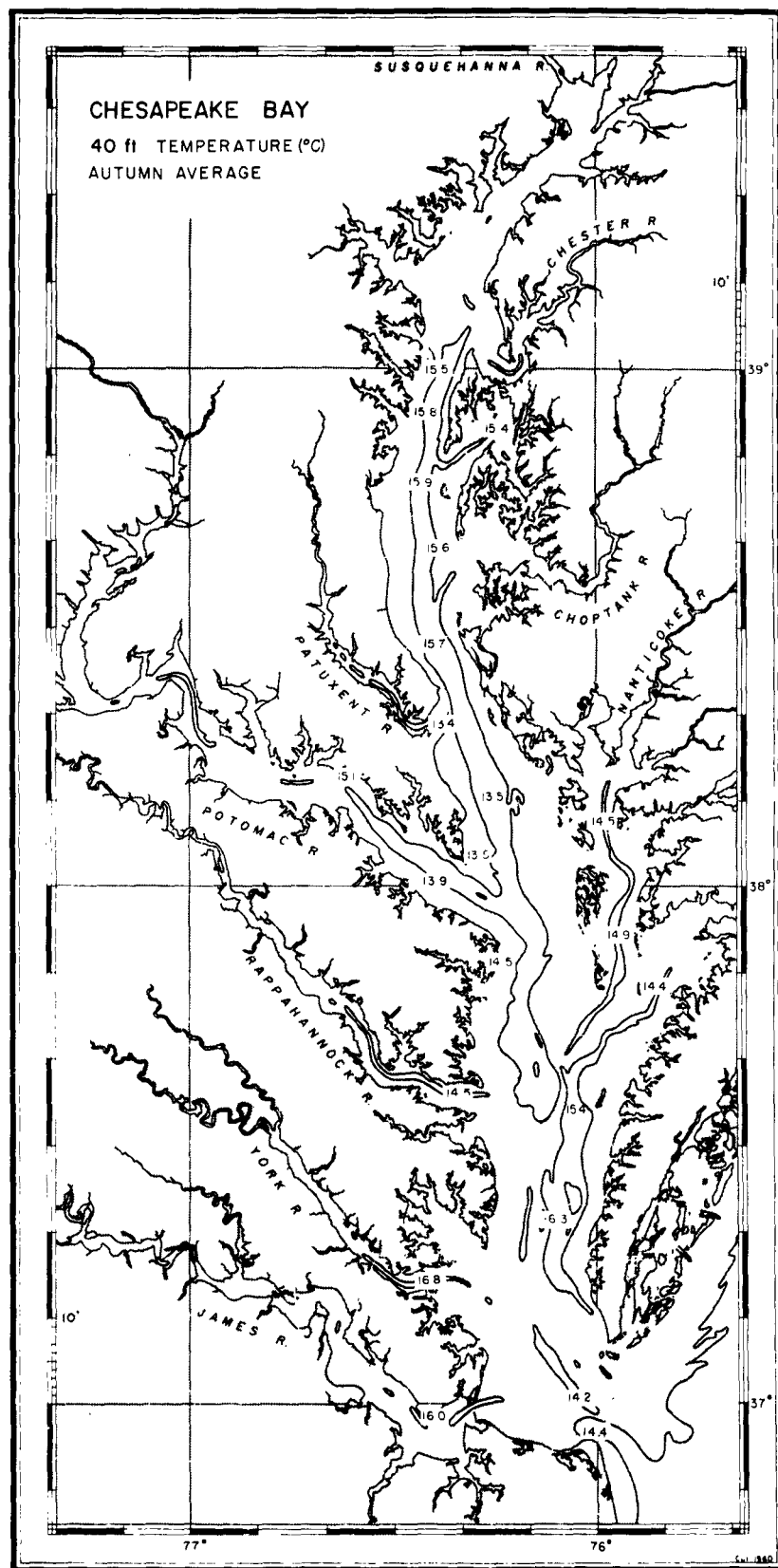


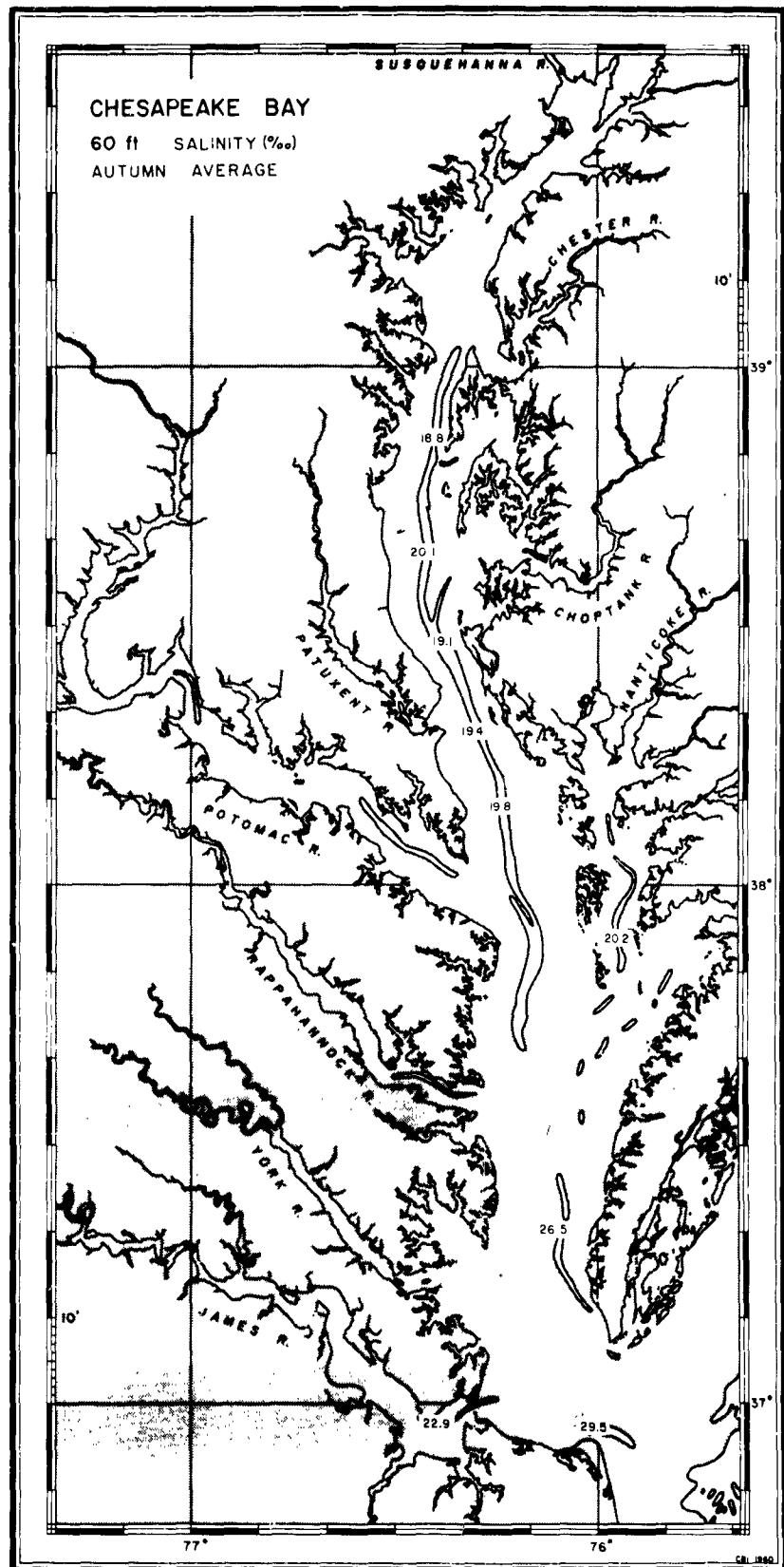




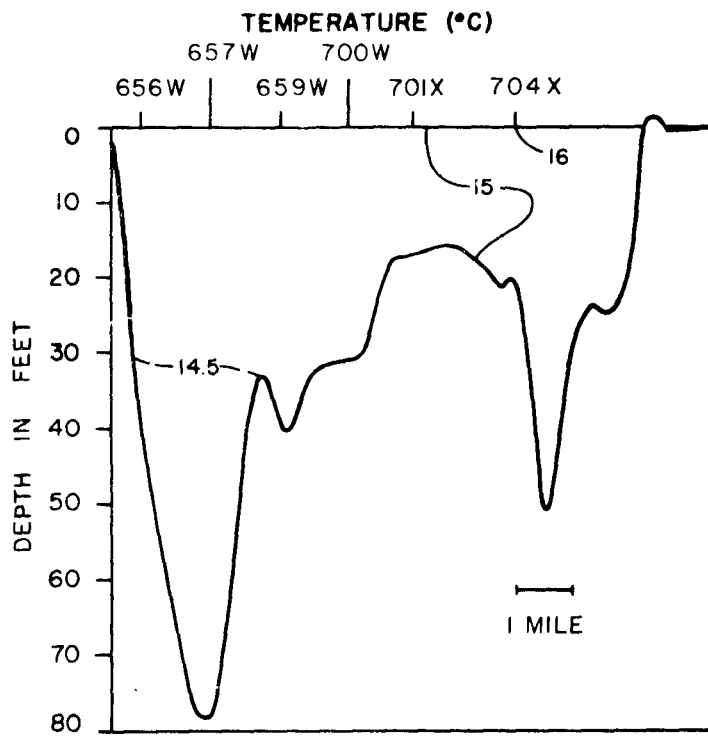
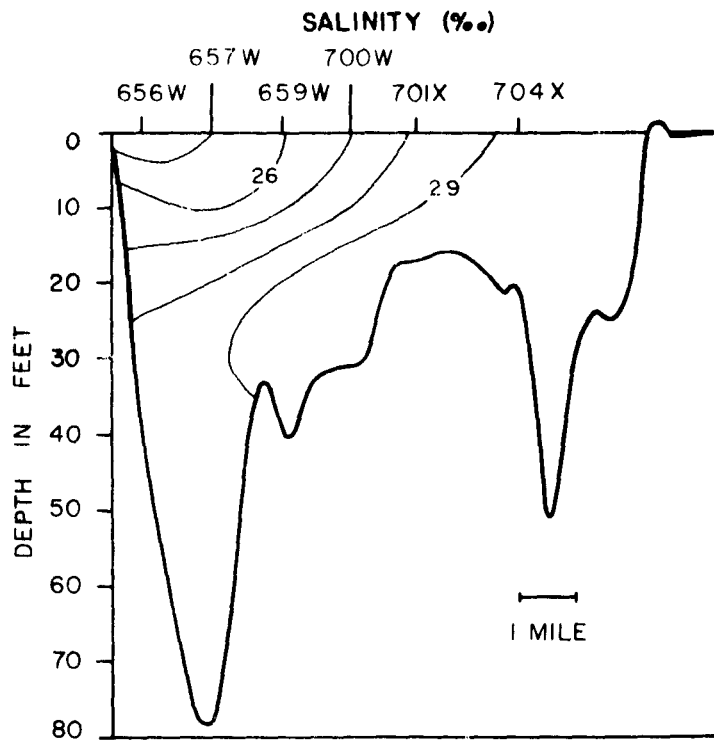




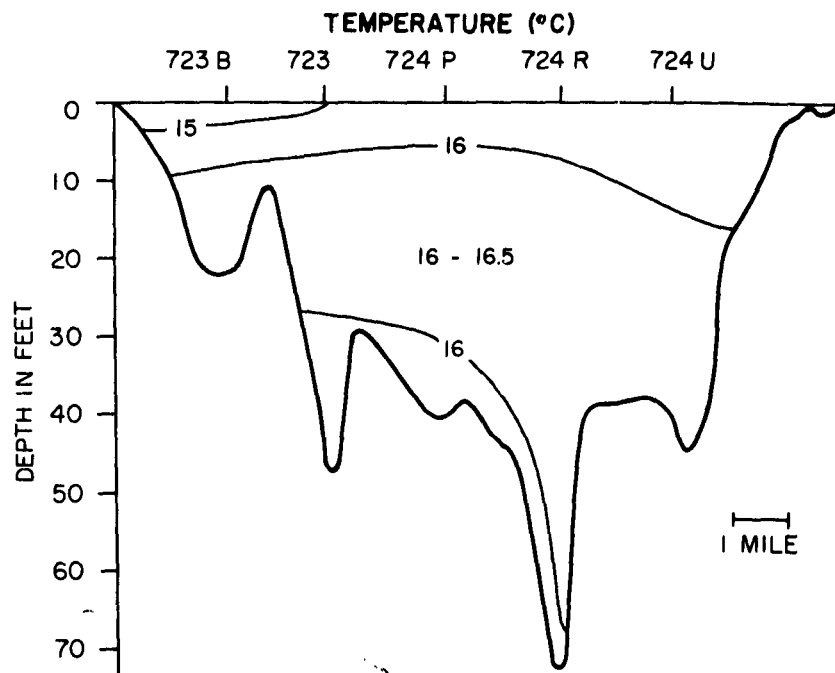
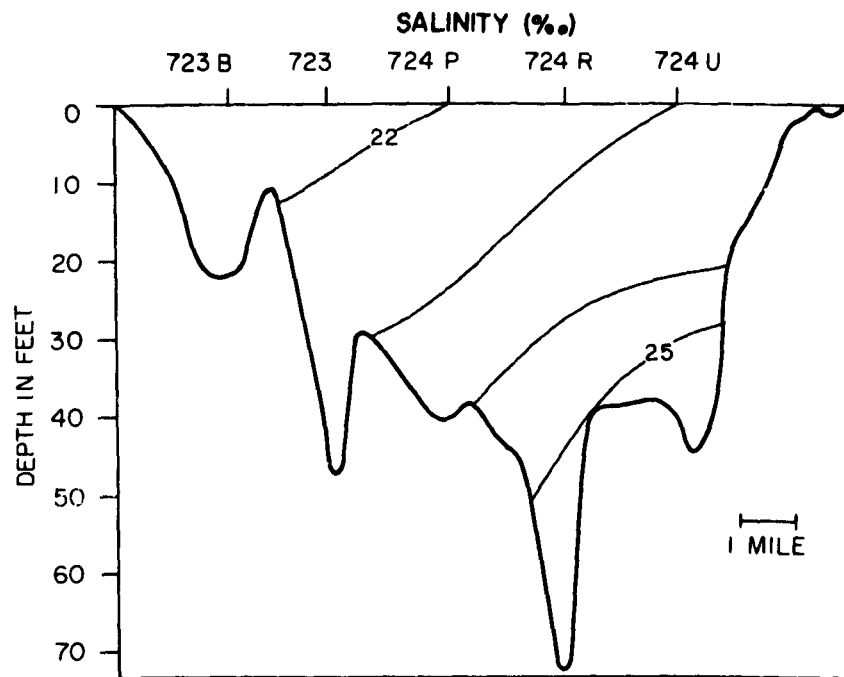




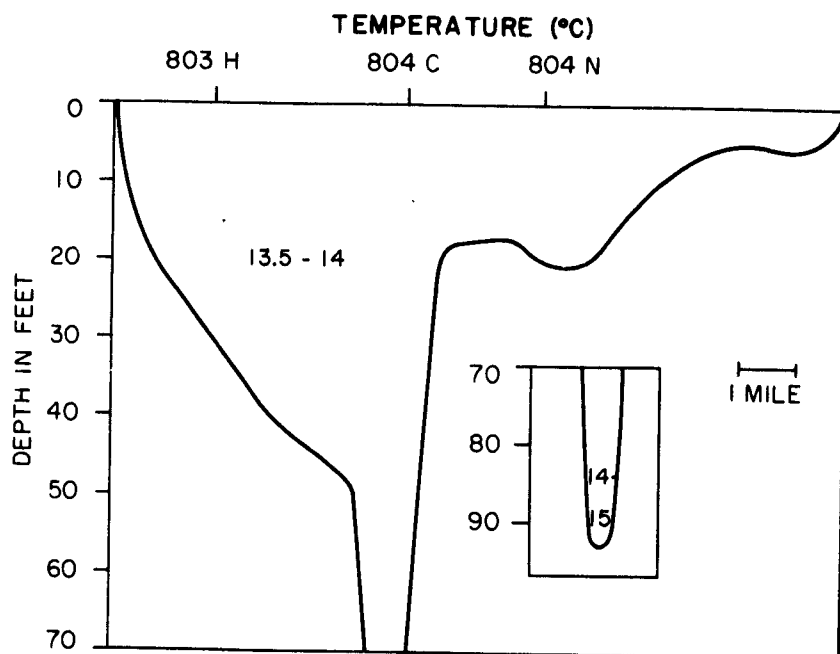
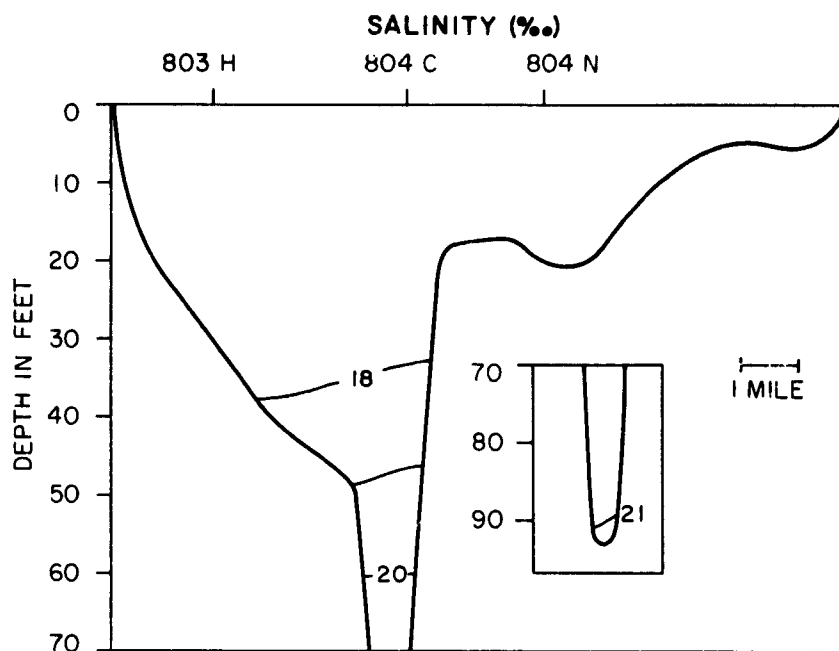
AUTUMN AVERAGE SECTION II



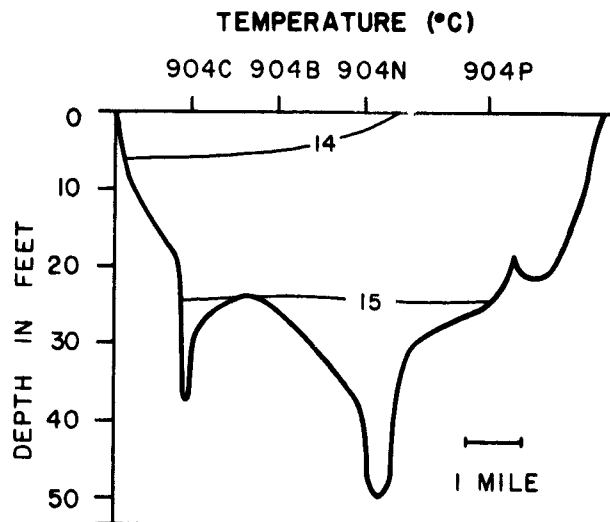
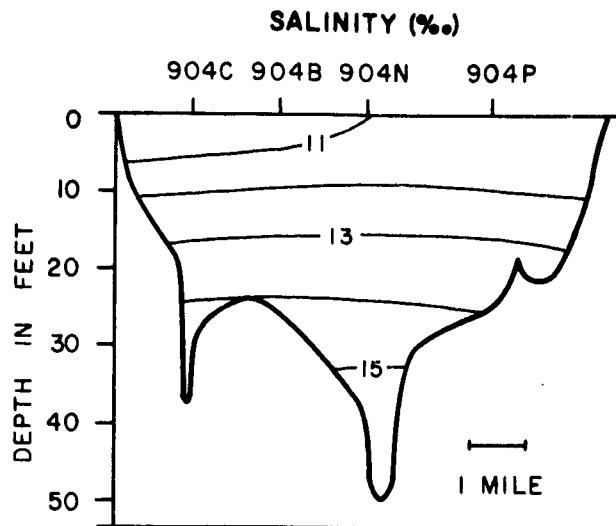
AUTUMN AVERAGE SECTION IV



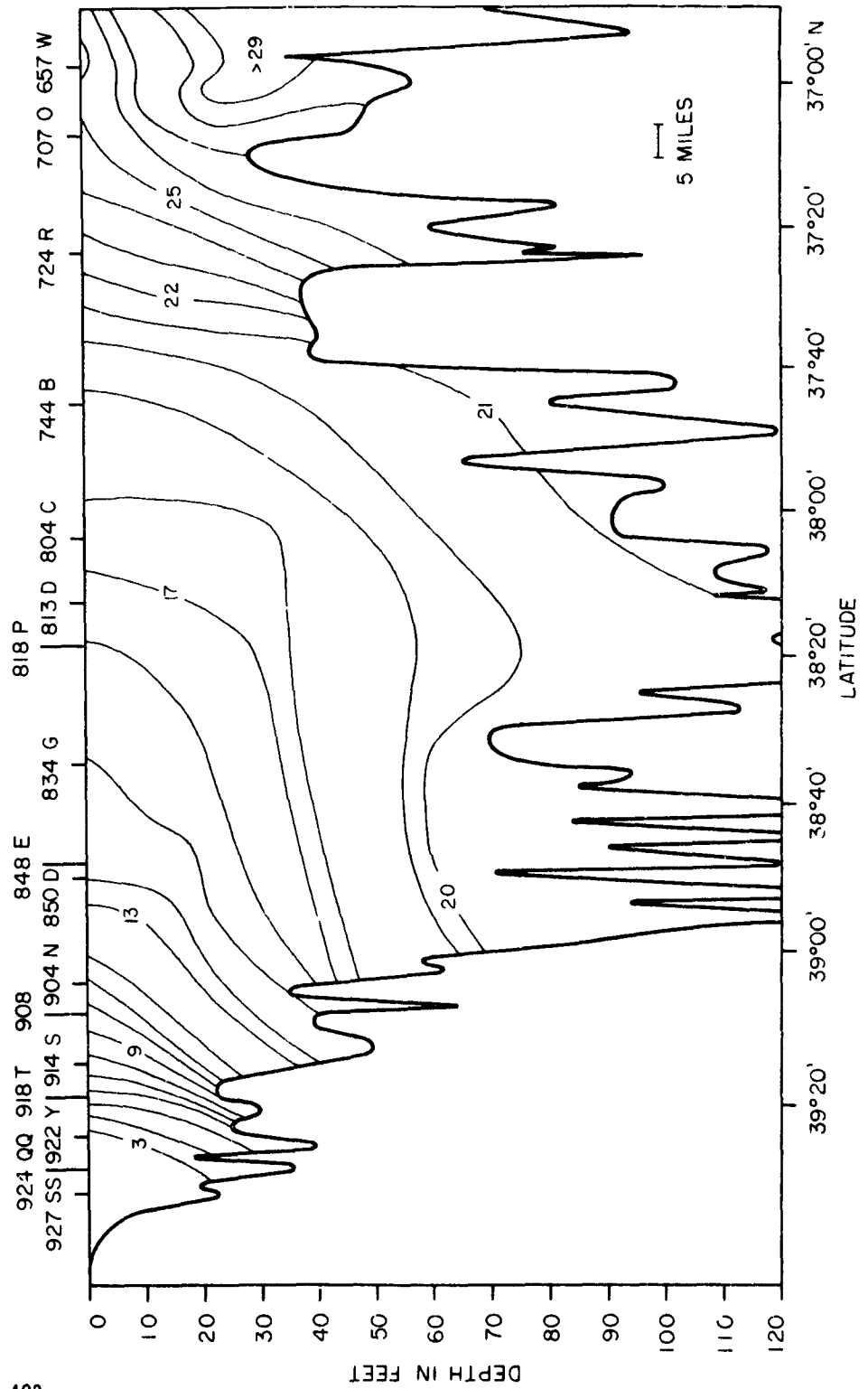
AUTUMN AVERAGE SECTION VI



AUTUMN AVERAGE SECTION X



AUTUMN AVERAGE SECTION XIX SALINITY (‰)



AUTUMN AVERAGE SECTION XIX TEMPERATURE (°C)

